

Historic, Archive Document

Do not assume content reflects current scientific knowledge, policies, or practices.





TX537
R8

ACCOUNT NO. 13318	TITLE NO. 0	STYLE Monograph	SLOT 24 23 22	TITLE / VAR FOOD STABILITY SURVEY
ISSN.				
NAME NATIONAL AGRICULTURAL LI 10301 BALTIMORE AVE ATT: DANIEL C. LECH BELTSVILLE, MD 20705				
VOL. / YR.	FREQUENCY 1	PERM. CHANGE <input type="checkbox"/> NEW TITLE		
PERIODICAL		BOOK		
TITLE PAGE		RECASE <input type="checkbox"/>		
TABLE CONT.		MOUNT COVER <input type="checkbox"/>		
INDEX		POCKET / CLOTH <input type="checkbox"/>		
FRONT COVER		POCKET / PAPER <input type="checkbox"/>		
BACK COVER		<input type="checkbox"/>		
ADS		<input type="checkbox"/>		
<input type="checkbox"/> STANDARD BOOK		<input type="checkbox"/> FLEX-S		
<input type="checkbox"/> CUSTOM BOOK		<input type="checkbox"/> FLEX-M		
<input type="checkbox"/> THESIS		<input type="checkbox"/> MUSIC		
<input type="checkbox"/> DUSTIE		<input type="checkbox"/>		
INSTRUCTIONS TO BINDERY: DOUBLE TAN ADHESIVE				

COVER COLOR 588	SET OF
PRINT COLOR W	1
BINDERY USE ONLY	
HAND TRIM <input type="checkbox"/>	STF <input type="checkbox"/>
RECASE <input type="checkbox"/>	STUB <input type="checkbox"/>
EXTRA TIME _____	MIN.
REASON _____	
OTHER _____	



LIBRARY COPY

Lot: PM1-100 Item: 87



U. S. DEPT. OF AGRICULTURE
NATIONAL AGRICULTURAL LIBRARY

MAR 27 1973

CATALOGING - PREP.

FOOD STABILITY SURVEY

Volume II

Rutgers University
The State University of New Jersey
Department of Food Science
for the
State of New Jersey Department of Health

In cooperation with the

U.S. DEPARTMENT OF AGRICULTURE / ECONOMIC RESEARCH SERVICE

ABSTRACT

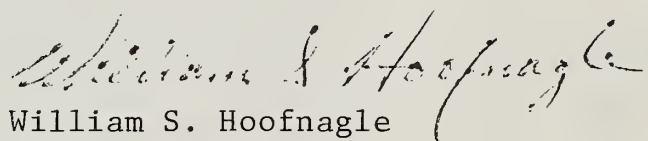
The findings and recommendations of a 1969 food stability survey by Rutgers University are discussed. This volume examines the shelf-life stability of 18 food-product groups and the various types of date labeling to protect the consumer against possible quality losses from food products. A review of legal literature on Federal, State, and foreign food dating/coding requirements is provided.

Key Words: Food shelf-life stability, Dating/coding, Food products, Retail marketing, Temperature/time, Quality maintenance, Consumer protection, Shelf-life tables.

FOREWORD

In 1969, the New Jersey Department of Health commissioned the Department of Food Science, Rutgers University, The State University of New Jersey, to conduct a survey of the shelf-life stability of food products. The Department of Food Science submitted its report on the research findings in September 1970. The report developed by Rutgers University was reviewed by staff members of the Marketing Economics Division, Economic Research Service, U.S. Department of Agriculture, and some modifications were made as an outgrowth of Department participation. The report is being published by the Department of Agriculture because of its concern with the subject and the work presently being done, as well as that contemplated on food product dating. ✓
The publication of this report is one facet of the Department's overall program on food product dating.

The findings and recommendations of the survey are those of the Department of Food Science, Rutgers University, and not necessarily those of the Department of Agriculture.



William S. Hoofnagle
Deputy Director
Marketing Economics Division

TABLE OF CONTENTS

	<u>Page</u>
HIGHLIGHTS.....	iv
INTRODUCTION.....	1
MEAT AND FISH.....	4
Meat Products Group.....	4
Fish Products Group.....	27
Poultry Products Group	38
BAKERY PRODUCTS AND SUPPLIES.....	44
MILK AND DAIRY PRODUCTS.....	62
Fluid Milk, Cheese, Ice Cream, Butter, and Dried Milk.....	62
Refrigerated Fruit Juices.....	85
Dips.....	90
Simulated Dairy Products.....	92
CANNED FOODS.....	97
PRODUCE.....	126
FROZEN FOODS.....	146
BEVERAGES.....	217
DRY FOODS.....	231
Breakfast Foods.....	235
Macaroni/Pasta.....	242
Dehydrated Vegetables, Fruits, and Soups.....	245
GARNISHES AND CONDIMENTS.....	254
Pickles, Olives, and Vinegar.....	254
Dressings.....	263
Sauces.....	269
Spices, Extracts, Seasonings.....	273
EGGS.....	281
OIL PRODUCTS.....	297
DESSERTS.....	312
Desserts and Toppings.....	312
Spreads.....	323
Syrup, Molasses, Honey.....	331

TABLE OF CONTENTS

	<u>Page</u>
CANDY AND GUM.....	337
Candy Products.....	339
Chewing Gum Products.....	345
SUGAR.....	352
BABY FOODS.....	361
NUTS.....	372
DIETETIC AND LOW-CALORIE FOODS.....	384
DELICATESSEN AND INSTITUTIONAL FOODS.....	391
LEGAL REPORT.....	402
Introduction.....	402
State Law Limitations on Legislative Control of Durability.....	403
Federal Law Limitations on Legislative Control of Durability.....	409
Analysis of Regulatory Models.....	415
Appendix I. Date Labeling and Related Statutes (Individual States).....	431
Appendix II. Date Labeling and Related Statutes (Foreign Countries).....	450
Appendix III. Date Labeling and Related Statutes (Federal).....	458
Appendix IV. Selected Annotated Bibliography.....	460

Washington, D.C. 20250

August 1971

HIGHLIGHTS

A 1969 survey of food shelf-life stability recommends the marking of an open date of manufacture on the exterior of shipping cartons by food processors, and the printing of an open date of shelf display by retailers. The report does not recommend the placing of an expiration or retail pull date on consumer packages because other factors, particularly temperature, are more significant in determining a product's shelf life than simply elapsed time. Until the storage and handling of products at all stages of the food supply system can be regulated and controlled by various levels of government, expiry dating would not seem to provide consumers with genuinely useful information.

The New Jersey Department of Health commissioned the Food Science Department of Rutgers University to conduct the survey to determine whether packaged foods may create a public health hazard or lose quality if not consumed before their shelf-life expiration date. The survey team investigated food date labeling with respect to its potential, necessity, or feasibility in protecting the consumer from hazardous, unwholesome foods. In addition to the 18 food product groups studied, the team also examined Federal, State, and international laws relating to food deterioration, date labeling, and shelf removal.

Some general findings of the survey are:

- (1) Available data on food-borne diseases indicate that health hazards from processed prepackaged foods are few. Therefore, the relationship of other types of quality loss--particularly aesthetic quality (color, flavor, texture)--to the age of packaged foods is emphasized.
- (2) Food qualities alter and may deteriorate with time. Most food processors endeavor to preserve foods to minimize the rate of alteration. Although processed foods are less likely to deteriorate than fresh foods, they do so in a readily apparent manner. If the food is impaired, changes in its aesthetic qualities--color, flavor, texture--are obvious, and the consumer can reject the food.
- (3) In general, food manufacturers employ diverse coding and shelf-monitoring systems for quality maintenance. Many of these cryptic coding systems are designed for inventory control and for identification and withdrawal of items if difficulties arise after the product has been distributed.
- (4) At present, consumers would not benefit from knowing the actual date of processing of most packaged foods since this information, by itself, would not indicate expected product durability.
- (5) An open date indicating the end of a product's shelf life (expiration date) is not beneficial because product quality can only be assured

if proper handling of the product is guaranteed during distribution. Adequate regulation of the postmanufacturing industry is currently insufficient to assure a reasonably abuse-free distribution system. Durability dating (reasonable storage time at a given temperature) could be acceptable for those companies or States which ensure that product handling is controlled from processing to retail sale.

The recommendations discussed in the report include:

- (1) Federal and State food laws and sanitary requirements should be reviewed from legal and technical standpoints to determine their effectiveness and degree of enforceability. High-quality sanitary requirements, based on microbiological standards, should be established for all equipment and personnel coming in contact with food at all stages of the food supply system. The Food and Drug Administration's "Good Manufacturing Practices," which now apply only to the processor's premises, could be the basis of such requirements.
- (2) Legible manufacturers' coding, whether cryptic or open, should appear on each unit package of food for identification of items.
- (3) The manufacturer should clearly print on the exterior of each shipping case, carton, or overwrap the date the product was manufactured. The exterior case should also give information on any specific storage requirements, such as temperature or relative humidity.
- (4) An open date of shelf display should be applied by the retailer at the time of pricing to facilitate stock rotation both in the store and home. Supplemental education on proper storage temperatures should accompany this dating.
- (5) The placing of an open date of manufacture or a shelf-life termination date on unit packages is not recommended. The date of manufacture does not provide the consumer with useful information about the potential life of the product. Because time is only one of many factors affecting quality and since a decided transitional change in packaged food quality based on a date rarely takes place, termination dating should not be initiated.
- (6) Each food industry, consistent with its specific technology and experience, should provide guidance to consumers on home storage conditions and on the maximum length of time food items may be wisely stored before being used.

FOOD STABILITY SURVEY

INTRODUCTION

This volume--the second of the two-volume report of the Food Stability Survey conducted by Rutgers University for the New Jersey Department of Health--provides detailed information and recommendations on 18 food-product groups and the results of a legal survey of Federal, State, and foreign food dating/coding requirements.

For ease and consistency of organization, each chapter is broken down into specific sections in accordance with a general format. In some instances, several sections in a chapter are combined for better reading, and are so noted in the text. To facilitate the reader's understanding of the format, the titles and inclusions under each section within a product group are listed below. Following the outline, some dating terms used through this volume are defined. A more complete list of definitions is included in volume I.

I. INTRODUCTORY REMARKS

This section introduces the subject matter of the particular food class or product group of interest.

II. SUMMARY OF RECOMMENDATIONS

This section presents recommendations on the optimum means of achieving "quality" of food, based on considerations of (a) the dating concept, and (b) other means of quality improvement not of a dating nature.

III. TYPE OF FOOD AND PRODUCT GROUP

This section classifies food groups on the basis of their sales volume according to the most recent information available during the survey, and from data provided in the publication of Chain Store Age.^{1/} The following general breakdowns were defined and established:

Department or Major Department. The classification of food by type, e.g., canned, dry, beverage.

Product Group. A subclassification given within a department, e.g., canned fruit, canned vegetables.

^{1/} Chain Store Age, 1969 Supermarket Sales Manual, Lebhar-Friedman, Inc., New York, N.Y., July 1969.

Category or Product Category. A further classification within the product group, e.g., in canned foods--beans, peaches, sugar.

Variety or Product Variety. A classification within categories by variety, e.g., beans--wax, sugar--granulated, pineapple--sliced, etc.

Item or Food Item. Throughout the survey, this more ultimate classification was generally avoided because of possible ambiguity afforded by its use. An item is defined in the retail trade as any one food article of particular size, brand name, or weight, found within a department, product group, category, or product variety, and as such was too restrictive for general use.

IV. TYPE OF PROCESSING AND PRESERVATION

This section reviews principles and practices of processing and preservation of the particular food grouping.

V. QUALITY CHARACTERISTICS

This section describes factors of general "quality" of the particular food group.

VI. PROCESSING AND STORAGE QUALITY LOSS FACTORS

This section identifies those sources of significant quality losses encountered in processing and storage during passage from the "field" to the customer. Also discussed under this section are common industry practices to assure quality maintenance in channels of distribution and retail locations.

VII. PRACTICES OF CODE DATING/PUBLIC DATING

This section provides information received from cooperating food processing firms on (a) voluntary food industry code dating and monitoring practices; and (b) legal or required dating, including Federal, State, municipal, and foreign requirements.

VIII. FOOD PRODUCT ITEM LIST--SHELF LIFE

This section contains an alphabetical listing of foods in each particular grouping and their shelf life. The data present the main shelf-life times from food industry sources and, occasionally where applicable to the retail situation, from scientific sources. The actual food industry sources are referred to by code number instead of name. Brand information and names have been altered to suit such requirements of "disguise." This disguise is maintained because in many instances the information revealed to the survey team was made available only on the basis of such anonymity.

IX. RECOMMENDATIONS ON BEST MEANS OF FOOD QUALITY MAINTENANCE

This section presents an analysis and discussion on the best means of assuring better food quality.

X. REFERENCES

References to literature cited in the report are given in the text by underscored numbers in parentheses, and as collections at the end of each chapter. References to food companies in the body of the text are listed by a code number followed by FIS, i.e., Food Industry Source. A list of co-operating company names, associations, research laboratories, and individuals in the United States and foreign countries is provided in appendix A of volume I.

XI. REPORT REVIEW COMMENTS

This section contains comments of food industry and trade associations after they reviewed various sections to which they had contributed.

DEFINITIONS

Code dating--cryptic (alphabetic or numerical codes) or secret systems, e.g., 700825 means August 25, 1970.

Public or open dating--implies publicly divulged specific date of final packaging, pull date (after which the product should not be sold), or expiration date (after which product should not be consumed).

Durability dating--dating systems which employ both temperature and time in a general rather than specific sense as the basis of shelf-life labeling, e.g., British 3-Star System for Frozen Foods.^{2/}

Shelf-life termination--the point at which some significant reduction in "quality" has taken place at a known temperature and humidity.

^{2/} See chapter on "Frozen Foods."

Chapter 1

MEAT AND FISH

I. INTRODUCTORY REMARKS

Meat is the largest department to be found in retail stores. In 1968, it accounted for 23.8 percent of the total sales volume of products sold in supermarkets (1). 1/ Included in this major department are the following fresh product groups: Beef, pork, lamb, veal, poultry, and fish. This chapter is divided into three main divisions: Meat Products Group, including beef, pork, lamb, and veal; Poultry Products Group; and Fish Products Group. Canned, frozen, or other processed forms of this major department are found in other chapters of the report, under specific food type.

Meat Products Group

The meat industry ranks among the top U.S. food industries for many reasons. Products in this group constitute the main source of protein for consumers, and are served in most homes at least once a day. The shelf life of all products in this major supermarket department varies, depending at all stages on sanitation, temperature, and packaging.

II. SUMMARY OF RECOMMENDATIONS (see also section IX of subsequent divisions)

These recommendations are intended to apply to all the products in this major department. Specific divisional product group recommendations are noted separately below.

A. Adoption by the New Jersey Department of Health of the Wholesome Meat Products Act of 1967.

B. Adoption by the New Jersey Department of Health of sanitary guidelines for all meat-processing plants, storage warehouses, butcher shops, retail outlet meat-cutting rooms, etc., in the State along the lines of the Sanitation Handbook of Consumer Protection Programs, prepared by U.S. Department of Agriculture (USDA) meat inspection specialists, October 1, 1968.2/

C. Adoption by the New Jersey Department of Health of the Coding Recommendations of the FDA Good Manufacturing Practices, Federal Register, April 26, 1969, for processed foods. Disclosure of code meanings by food manufacturers to the New Jersey Department of Health on request by the latter.

1/ Underscored numbers in parentheses refer to items listed in the References at the end of each chapter.

2/ The New Jersey Department of Agriculture adopted the Sanitation Handbook in 1968. In 1970, the Federal Meat Inspection Program was proposed for adoption. Poultry inspection is also under consideration.

D. Adoption of the open date of manufacture labeling for all outer cases/overwraps, etc., to assist in stock rotation.

E. Voluntary coding of all individual containers in such cases/overwraps by the food industry with codes of its own choosing (similar in intent to C. above). Such codes should indicate plant location, date of manufacture of final products in container, shift, production line, and any other aspects of products, at the manufacturer's discretion.

In accordance with C., D., and E. above, it would seem acceptable to follow the 1970 American Meat Institute (AMI) Code. In early August 1970, the AMI Sausage and Processed Meats Committee adopted a new and revised four-digit code as follows:^{3/} First two digits represent month; second two digits the day of the month (e.g., 0824--August 24). The specific meat products, i.e., fresh, processed, canned beef, pork, etc., to which this code will be applied will be resolved at a later date by the AMI. The executive board of the AMI adopted this as general policy in February 1971.

F. Stamping of date of shelf display, which should be date of packaging, by retail stores for stock rotation and as a consumer aid in home storage stock rotation.

G. Expansion of instructions for consumers' use and storage.

H. A program over a 5-year period designed to reduce the temperature of retail meat display cases to 28°F. should be considered as a means to substantially extend shelf quality of fresh meats.

Specific Product Group Recommendations

Meat--Labels of all wrapped retail cuts of meat (including beef, pork, veal, lamb, etc.) should be stamped with an open date of shelf display, i.e., day and month (in English) of packaging.

Date of expiry or AMI's "quality assurance" date system should not be used for retail cuts of meat without the permission of the New Jersey Department of Health. Systems for such should be presented to that authority and demonstrated as scientifically sound. The applicant should offer evidence of his capability of policing such systems for which he must assume full responsibility.

Such retail cuts should clearly state the intent of the dating as date of shelf display, date of expiry, or quality assurance date, by clearly spelling out the words as distinct from using abbreviations.

A. Ground beef or hamburger meat should be publicly dated with date and time of packaging and should typically state on the labels of all packages, "Use or freeze within 24 hours of purchase; if product is frozen after purchase, defrost at refrigerator (38°F.) temperatures, or under running cold water tap.

^{3/} Revised from the Institute's 1961 Recommended Meat Code discussed in section VII A. below.

Do not defrost at room temperature (70°F.)." If, for reasons of aesthetics, ground beef must be rewrapped by the retailer, the original time and date of wrapping should be printed on the new label.

B. Canned hams, consumer-packaged cold cuts, and any mildly processed (pasteurized) products in cans or flexible laminated films should be stored at refrigeration temperature (38°F.) and numerically production code dated, i.e., date of manufacture in the recently recommended AMI Code (August 1970). Such dating would permit the Department of Health or other authorities to check on product rotation in retail stores and warehouses, and enable all retail outlets to monitor and rotate their stocks. Such codes should preferably be embossed or indented into the appropriate containers and not simply stamped on. Date of shelf display should also be employed at the retail level. Any expiry coding, if used, should be based on the manufacturer's experience, be clearly designated as such, and be substantiated to the Department of Health when possible by technical and scientific data.

C. Fresh poultry and fish should have the same label instructions as ground beef, i.e., use within 1 day of purchase. They should also show the date of shelf display, i.e., date of retail packaging. No specific expiration date could readily be established for poultry because of the variables that affect periods of salability, except for date of shelf display packaging, i.e., day and month.

Fresh Fish--Date of retail packaging shelf display is recommended on fresh fish, i.e., day and month (in English). Smoked fish do have a Federal requirement for public expiration on a 14-day basis, as noted later in this chapter. Codes of sanitation and practice for fresh fish should be established by the New Jersey Department of Health. All fish that is frozen and then sold as fresh fish should be designated clearly as such, e.g., "This product has been thawed from the frozen state at refrigeration temperatures (38°F.), keep refrigerated until used." Placards should be placed in all retail fish outlets denoting that fish should be stored under refrigeration and used or frozen as in the case of ground beef. For aesthetic and nutritional quality reasons, consumers should be advised against refreezing of thawed fish.

III. TYPE OF FOOD AND PRODUCT GROUPS

Meat, by product group, category, and variety

<u>Product groups</u>	<u>Product category</u>	<u>Product variety</u>	<u>Percentage of total super-market sales</u>	<u>Percentage of department sales</u>
Meat	Beef		7.60	32.1
	Veal		.29	1.2
	Lamb		.30	1.3
	Pork	Fresh	3.55	15.0
		Smoked	3.19	13.5
		Hams, canned	.60	2.5
	Luncheon meat	Packaged	1.73	7.3
		Bulk	.43	1.8
	Sausage meats		.52	2.2
	Frankfurters and wieners		1.80	7.6
			.19	.8
	Variety meats		.15	.6
	Miscellaneous			
Poultry	Fresh		3.32	14.1
Fish			--	--
			23.67	100.0

Source: These figures were obtained, with permission, from Consumer Dynamics in the Supermarket, published by Progressive Grocer in 1966 (17). A similar breakdown is not presented in Chain Store Age, 1969 Supermarket Manual (1). Sales for the entire meat department in the latter publication were reported as 23.81 percent of total supermarket sales for 1968. Despite the different years, the breakdowns were assumed to be rather similar, owing to the similarity of the data in both sources. No data were available for fish product group.

IV. TYPE OF PROCESSING AND PRESERVATION

A. Principles

The principles of meat processing and preservation should involve the slaughtering of animals and separation of component parts under strictest specifications and conditions of sanitation, temperature, and packaging for final consumption of the products to reduce the possibility of any health hazards.

B. Practices

1. Beef--Keeping quality of beef is improved by the practice of resting the cattle before slaughter. After slaughter in a humane manner, the carcass is disbowled, its hide is removed, and it is aged under refrigeration of 35°F. The aging requires 5-10 days. During this period, there is a noticeable loss of moisture from the meat, with resultant loss in weight. This loss can range from a small percentage of carcass weight to 6-8 percent on packaged finished primal cuts. The aging process adds to the cost of meat because of: (1) The cost of refrigeration space during the aging storage, and (2) the actual evaporation weight losses. The industry attempts to control such losses at minimal levels. However, such loss occurs because the carcasses, even when wrapped with paper or with other materials, must dry out to reduce the favorable conditions which moisture presents for growth of surface bacteria. In addition, aging permits the action of biochemical enzymes systems which produce a tenderizing effect. The biochemical actions of the aging process continue to take place during transit, display, and home storage. Aging ends only when the product is finally cooked. Beef is more commonly aged than is pork, veal, or lamb.

Figure 1 shows the effect of aging time on tenderness.

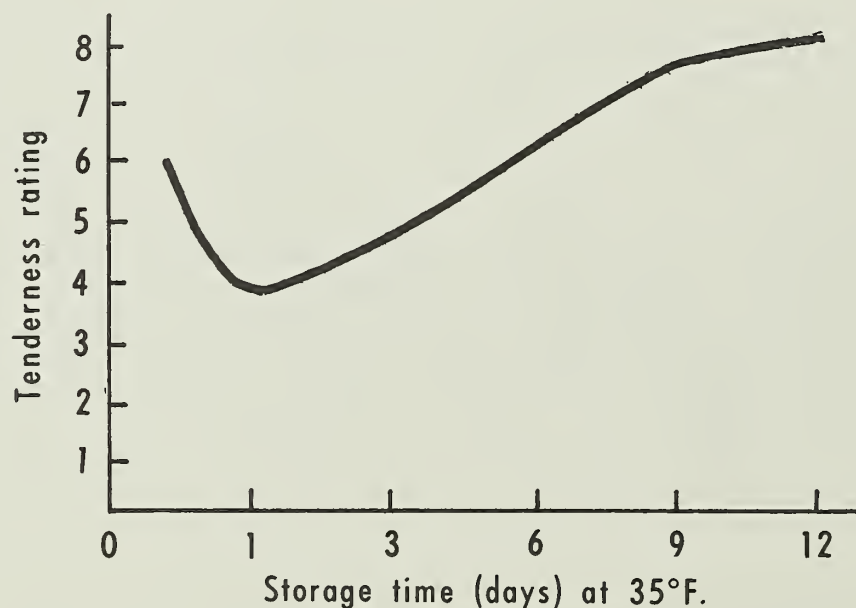


Figure 1.--Effects of aging on tenderness of beef

Source: Brissey and Goesser (2) in a book entitled Food Processing Operations by M. A. Joslyn and J. L. Heid, published by The Avi Publishing Co., Westport, Conn. Used with permission of publisher.

2. Pork--Hogs, like beef cattle, are held for rest periods before slaughter. They are slaughtered and processed in a manner similar to beef. Usually 18-24 hours are required to reach the 35°F. internal temperature. Hogs shrink in weight during chilling, and may lose as much as 1.5 percent

carcass weight. They are shipped either as entire carcasses, or are cut into wholesale pieces at the packing plant. Final cutting into consumer portions is done in retail meat departments.

3. Veal--The processing of veal is quite similar to that of beef, but the carcasses are generally not aged because they are usually tender. They are chilled to an internal temperature of 35°F. This process usually requires less than 24 hours, after which they are ready for shipment. They are cut up into sides and further fabricated into retail cuts in retail meat markets.

4. Lamb--Processing steps are generally similar to those used for the foregoing animals, with appropriate modifications. The carcass is chilled to just above 32°F. internal temperature. This requires 23 hours or less; aging takes 7-10 days. Complete lamb carcasses are seldom aged. Either whole carcasses or divided carcasses are distributed for final portion cutting to the retail markets.

C. Processes of Preparing Consumer Meat Products

1. Fresh Retail Meats--Meats may be further processed in butcher shops or in supermarket outlets. These retail operations are considered relatively simple. In the individual butcher store, the pieces are generally cut to specific weight orders. In the supermarket, the cuts are usually made up in advance, packaged in paper or plastic trays, overwrapped with transparent films, sealed, and weighed with appropriate allowances for wrapping material weight.

The degree of sanitation (as distinct from cleanliness) with which the meat is handled in such retail meat outlets as well as sanitary conditions and prevailing temperatures of cutting rooms influence the storage life of packaged meat. These matters control the level of microbial growth and the shelf life of fresh meats. When such operations are carried out in the sales area, with surfaces of meat exposed to the prevailing store temperature (70-80°F., summer-winter) and to possible bacterial contamination from the surrounding air, they are poor practices which only education about sanitation can remedy and which coding or date labeling would not prevent.

Chopped meats or hamburger meats, when prepared in advance of sale, are usually ground in the refrigerators of supermarkets or retail shops rather than at higher temperature cutting places, and wrapped and weighed in the same way as meat cuts. It is important to note here that the prevailing combination of sanitation and temperature controls of raw materials, equipment, and personnel affect the storage life and wholesomeness of chopped meat much more so than they do in the case of slices of meat. Any contamination which occurs on slices is on the exterior surface of the meat rather than in the "sealed" interior. However, in chopped meat which has a larger surface area, contamination of a greater surface area may occur during the meat-grinding operation from the mixing of contaminated surfaces with fresh ground surfaces of the ground meat. If this occurs, it causes growth of odor-producing microorganisms, and may be a potential health hazard if the meat had high original microbial content. This particular problem may arise more often when retail cuts which are removed from sale because of color loss are reground for chopped meat purposes.

Consequently, in view of such variables, setting a date for expiration on ground meat would be a statement of extremely uncertain value.

2. Variety and Glandular Meats--Most of the products under this heading are highly valued nutritionally and have a larger surface area. They constitute only a small percentage of the weight and size of a total carcass. They may be subject to considerable handling, and are therefore exposed to greater possibilities of microbiological contamination. These items are therefore more perishable and require more sanitary practices than regular meat products. Their preparation involves little more than trimming, washing, packaging, and immediate refrigeration, usually in the meat-packing plants. Retail stores break down such larger packaged units to meet consumer needs.

3. Sausages and Related Items

a. Fresh sausage--Fresh sausage is made from fresh meats, principally pork. There is ordinarily no heat treatment involved. The meat is comminuted to varying degrees from coarse to fine, and salt and spices are mixed into the comminuted meat. The mixture is then extruded into casings, whether natural or synthetic, which are twisted at given places to form links. Links may be packaged in vacuum films or in trays with overwraps, or sold loose in lengths. The product may be also extruded into bags of 1- or 2-pound sizes.

Fresh sausage is very perishable because there is no heat treatment at any stage in the manufacturing process to inactivate or destroy any bacteria accumulated during all of the handling stages. Additionally, the added spices may be a source of contamination. Fresh sausage is universally cooked by the consumer before consumption. In this heating, any pathogenic bacteria or trichinae are likely to be killed.

b. Smoked, cooked, or smoked and cooked sausages--These sausages include a wide variety of products such as: Bologna, Polish, Berliners, and others. The type of meat, grind, curing method, casing, smoking, and other factors determine the nature of the product (3). Generally, the meat for all these sausages is cured in some manner. They are processed in somewhat the same manner as fresh sausage and may be smoked or heat treated thereafter. They have good keeping qualities, particularly at low refrigeration temperatures. (Curing is discussed under cured meats below.)

4. Cured Uncooked Meats--Curing chemicals generally used include sodium chloride (salt), sodium nitrate, sodium nitrite, phosphates, ascorbic acid or one of its derivatives.

Curing is accomplished by one of two methods: (a) Dry salting, or (b) pickling. In the dry curing method, the meats are either rubbed with or packed in the curing salts. This process is usually done at temperatures of 35-40°F. to prevent spoilage while the cure is taking place. Pickling cure is done by one of several modifications. In one method, the meat is immersed in a water solution of the pickling salts, and immersion continued. To promote penetration, the solution may be pumped deep into the meat interiors with a hollow needle. Another refinement of this is to pump the pickling solution into the arteries of hams to achieve relatively rapid infusion.

Still another refinement is the use of a machine having multiple hollow needles spaced at 1 or 2 inches from one another in a manifold head. Thus, a whole series of injections can be made in one quick pressing. Cured products are usually packaged under vacuum in flexible polymeric films, or may be just overwrapped in meat-packaging film. Many of the products must be stored under refrigeration, 38°F. While these products are capable of spoilage, it may be detected by the consumer who can readily notice the cloudy liquids in the package as against the clearer red pickle solution normally found in vacuum-packed films of these products.

5. Smoked Cooked Meats--Virtually all meats which are smoked have first been cured. The degree and method of smoking have changed over the past years. Formerly in this country, as is still the case in many foreign countries, meats were smoked and cooked to preserve them. At present, however, modern refrigeration has minimized the need for actual cooking during smoking. Today, smoking is essentially done to give the meat a desired flavor. Smoking is accomplished by hanging the meat in a chamber into which wood smoke is introduced. Smoking time and temperature are variable, depending on size and type of product. Time and temperature are controlled and varied for different products to produce the desired color and flavor with minimum weight losses. Smoked meats require chilling and refrigeration after processing. The shelf life of smoked meat is frequently limited by the stability of its fat to rancidity.

6. Packaged Meats

a. Luncheon--Many of these products are compressed in molds and are formed into "loaves" in rectangular or other desired shapes in order to produce uniform shapes for slicing. These "loaves" are sliced and vacuum or gas packaged in specially laminated transparent films (8) in the processing plant into consumer-sized units for retail sale.

Slicing and packaging operations require emphasis on good sanitary practices throughout to prevent the introduction of conspicuous numbers of bacteria, especially of the pathogenic type. Although the majority of these products are pasteurized to a minimum of 155°F., they are not sterile, and can undergo recontamination during slicing, conveying, or at wrapping stations if sanitary monitoring is inadequate. These products have a limited shelf life and require surveillance by manufacturers and retail store managers. Refrigerated storage, preferably at 38°F. or lower, is required.

b. Bacon--The stability of sliced bacon depends on how it is packaged. If it is not vacuum packed, the following likely changes will occur: (1) Drying out, causing weight loss and reduction below weight designations; (2) may develop molds and yeasts in 2 to 4 weeks; and (3) rancidity may become evident within 4 weeks (may occur sooner if the bacon is sliced from thawed frozen slabs).

More than half the packaged bacon now sold is vacuum packed. Thus, packed bacon is on the borderline of being extremely stable, and will usually keep 30-60 days in such sealed packages, at refrigeration temperatures. Deterioration usually occurs when lactic and acid-producing bacilli cause souring. At such times, bacon loses its clean look and the package appears to lose vacuum because of gas production.

Bacon which is not vacuum packed should not be kept in the store more than 1 week. To assure fresh quality in the home, bacon should not be kept in the home refrigerator for more than 1 week on opening regardless of whether the package originally was vacuum packed.

V. QUALITY FACTORS OF IMPORTANCE

A. Color

The characteristic red color of fresh meat has been adjudged (perhaps erroneously) by the consumer as the primary sign of quality and freshness. This bright red (oxymyoglobin) color is developed when the purplish myoglobin is oxidized. Exposure to air and light changes the bright red to brown metmyoglobin (fig. 2).

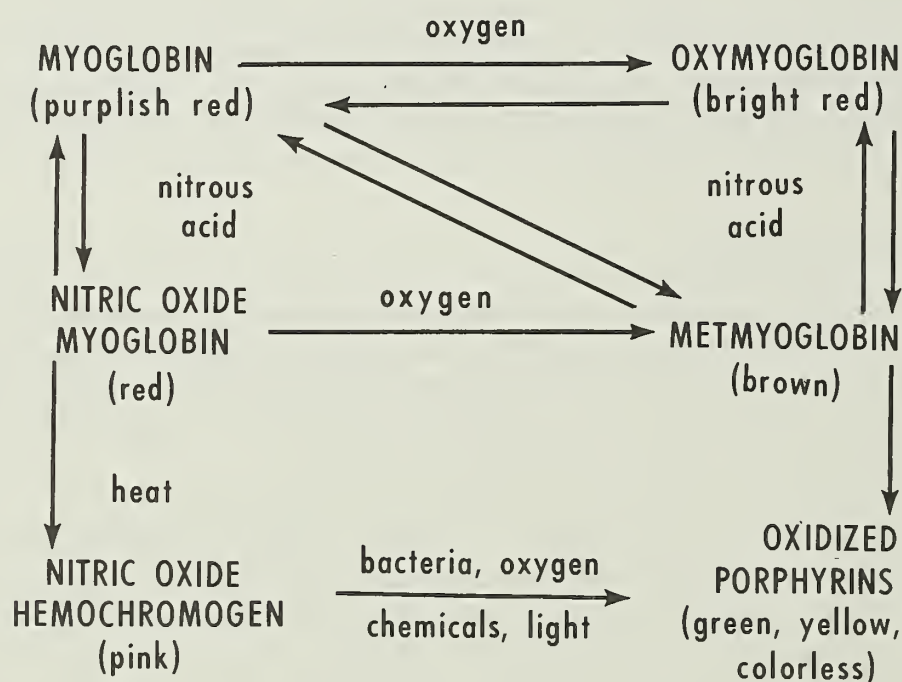


Figure 2.--Proposed pathways of color changes observed during curing and handling of meats

Source: American Meat Institute (4). Used with permission of the Institute.

Many cured and smoked products, including sausages, have a pink color which is accepted by the consumer as normal. The pink color is fixed by the curing or smoking processes, or by both, and is not subject to a change to brown color as in the case of fresh meats.

Other changes in processed packaged meats may take the form of milky, grayish film owing to moisture separation and subsequent bacterial growths.

B. Flavor and Odor

Changes in meat odor are often related to microbiological growth and deterioration. This growth occurs more readily with meats and meat products which have had excessive handling. Rancid odors may develop in high fat products such as bacon. Such off odors may not be harmful and retail cuts with off odors could be eaten after cooking. Such odors are a required sign of aged meat in some countries. However, most consumers usually discard such meats, assuming the off odor to be a natural warning of possible health hazard.

C. Texture

Texture is mainly important in terms of tenderness. Tenderization commences in storage in the aging period which begins immediately after slaughter and lasts until cooking. However, some scientists theorize that it is the most important factor in determining eating quality and consumer satisfaction, i.e., if it was tender after cooking, it was "good" meat; if tough, it was "poor" meat, regardless of original color or its cooked flavor.

D. Nutritional Qualities

During normal aging and storage of meats, some nutritional losses occur in the form of reduction of one or more of the vitamins, including thiamine, riboflavin, and niacin. These losses, however, are usually not drastic. Loss of vitamins during curing of hams has been found to be nominal and somewhat increased by the smoking process. Subsequent storage produces no further losses (5). The results of cooking meat are discussed by Potter (6) who points out that the nutritional value of cooked meats is relatively high and that normal cooking procedures only slightly affect the protein value. Cooking meat until it is well done affects the vitamin B content, but even in the well-done state, most meats retain about 70 percent of the original vitamin B content.

E. Health Aspects

Some processed products, like fresh pork sausage, may be subject to spoilage, and require the application of strict sanitation procedures during processing. Subsequent refrigeration and shelf-life surveillance is necessary. Dating of some type is a possible consideration, but reliance by consumers on dating as an indication of the quality of products made under unsanitary conditions (in addition to uncontrolled or uncontrollable channels of distribution and retail practices) could lead to false security and possible health hazards.

The possibility of trichinae may be a hazard only if current prescribed practices are not carried out, i.e., cooking at correct temperatures for fresh pork products.

VI. PROCESSING AND STORAGE QUALITY LOSS FACTORS

A. Identification of Potential Causes of Quality Losses

Possible causes of quality loss, as indicated in the previous section, are related to microbiology (sanitation and handling), temperature control (refrigeration--38°F. or below), and packaging materials.

B. U.S. Government Quality Maintenance Practices

To attempt to control the factors in A. above, the Consumer and Marketing Service, USDA, operates systems and a service to help processors to achieve such aims. However, USDA plant inspection is presently only a requirement of meat plants operating in interstate commerce. Plants operating entirely for products sold within the same State (not engaging in interstate commerce) are governed only by individual State governments. The Federal Meat Inspection Act, as revised by the Wholesome Meat Act of 1967, however, requires all States to adopt and enforce meat inspection practices at least equivalent in thoroughness to Federal meat laws. New Jersey has proposed acceptance of the Federal inspection provided for under this revision.

On this basis, the State of New Jersey might consider the adoption on a voluntary or legally required basis of the practices described in the Sanitation Handbook of Consumer Protection Programs, prepared by the Consumer and Marketing Service, USDA, October 1968, with the extension of similar practices to all meat handlers, i.e., truckers, warehouses, retail stores, etc. The USDA handbook is a collection of sanitation guidelines for all meat plants producing meat under Federal inspection. The following abridged version of the table of contents of this manual shows its comprehensive nature as far as meat plants are concerned, but indicates the lack of guidance for the postmanufacturing processing industry, i.e., truckers, warehouses, retail stores, etc.

SANITATION HANDBOOK OF CONSUMER PROTECTION PROGRAMS

- I. Inspector's role in sanitation
- II. Plant management responsibilities
- III. Sanitation inspection
- IV. Developing a sanitation program
- V. Supervisor responsibilities
- VI. Sanitary report
- VII. Outside premises
- VIII. Plant construction
- IX. Plant lighting
- X. Plant ventilation
- XI. Plant refrigeration
- XII. Plant plumbing
- XIII. Plant water supply
- XIV. Plant drainage

A brief description of the USDA inspection and grading follows:

1. Inspection--All plants from which meat is shipped in interstate commerce are under the direct controls of the inspectors of the Consumer and

Marketing Service, USDA, whose functions are to assure the cleanliness and wholesomeness (absence of disease) of meat produced at those plants and to detect the presence of diseased meat and prevent its use as food. This inspection covers the basic packing houses as well as other meat-processing plants. Each plant is identified by a number, which appears in a specified design on each carcass and package processed by that plant.

2. Grading (voluntary--even for interstate commerce shipments)--The Consumer and Marketing Service, USDA, classifies meat into various grades on the basis of such factors as amount of fat, contour of the meat, marbling of the fat, texture and firmness, and color. These grades generally have little distinct relationship to consumer factors and generally describe aesthetic qualities of the meat. Higher prices are normally charged for the higher grades. Grading is usually done in the packing houses. Grade names, beginning with the best, are: Prime, Choice, Good, Standard, Commercial, Utility, and Cutter-Canner.

C. Food Industry Quality Maintenance Practices

The major meat industry association--the American Meat Institute--furnishes information in its publications covering quality maintenance. These publications are compilations of collections of recommended technical practices for its members.

One major processor (#680 FIS) of ready-to-eat meat products--luncheon meats, frankfurters, etc.--stated:

"You requested a general description of the processing of ready-to-eat products--realizing that there is a wide variety of products in this category and that they do not all receive the same process. However, the majority of these products are processed to a minimum of 155°F. and are thereafter immediately chilled to less than 40°F. prior to vacuum packaging. Many products are chilled to about 20°F. prior to packaging and all are stored at approximately 35°F. during assembly, storage and shipment to our customers."

The same processor further reported:

"Random samples are selected regularly from our production lines, and are stored at the temperature that we consider to be the maximum (45°F.) at which we could reasonably expect these products to be held and displayed in retail establishments.

"With the bacteriological method, initial counts are taken and additional bacteria counts are made at regular intervals until the count has exceeded that which we consider to be the limit for the particular product.

"With the organoleptic method, random samples are stored at the same temperature mentioned previously. Samples are regularly and carefully inspected for any evidence of bacteriological growth and are tasted to determine if flavor changes are being experienced. The test is considered terminated when the first evidence of bacteriological growth appears

visually, or when the flavor is no longer considered suitable for our brand. Note that the product is not necessarily spoiled or inedible at this point."4/

D. Channels of Distribution

The storage temperature of meat products is critical. Meat processors are aware of this factor. One major retail chain (#30FIS) listed the following temperature requirements for these products:

"Meat: Needs refrigerated equipment in warehouses, transportation, and stores, to provide better quality, and a higher \$ benefit.

Fish: Highly perishable
Inspection necessary to control quality and freshness
Immediate, constant, adequate refrigeration
Repack conditions most important.

Poultry: Inspections
Rapid turnover
Refrigeration a must."

The same retail chain (#30FIS) gave information on use and handling equipment temperatures:

"Meat: Refrigerated trucks

Fish: Temperature important

Fresh fish 32° to 38°F.
Frozen fish 0° to 5°F.
Mixed fresh and frozen 20° to 25°F.
Precooled refrigerated cars used.

Poultry: Refrigerated trucks."

Another major processor (#680FIS) of ready-to-eat packaged meats stated: "Our recommendation to the retailers is that our products be maintained and displayed at a maximum of 40°F." The processor further stated:

"Monitoring Product in the Field

In monitoring our product in the case, it is our policy to remove from the display case any product which is damaged, unwholesome, or unsaleable. The dealer is given full credit for said merchandise and the product is then decharacterized and destroyed. Our policy (on outdated

4/ The Supermarket Institute recently developed a meat sanitation program of considerable merit, which should be studied by interested persons. The Institute is located at 200 East Ontario Street, Chicago, Ill.

merchandise) is to remove it from the case if it does not meet our appearance standards. Full credit is given the dealer for any product removed. Our salesmen also work closely with our customers, checking rotation and adjusting their orders in order to keep the product in the case fresh and within control date."

E. Consumer Factors

A major processor (#680FIS) of ready-to-eat products--luncheon meats, frankfurters, etc.--who uses cryptic coding on its products stated with respect to consumer factors:

"In using this (shelf-life testing methodology) information to set out code dates, we seek to allow fourteen days for the consumer to store and use the products after the expiration of the control date. A minimum of seven days is allowed in the case of the more perishable products with somewhat limited shelf life."

The following paragraphs were taken from the highlights of Homemakers' Opinions About Selected Meats--A Nationwide Survey, Marketing Research Report No. 854, Statistical Reporting Service, USDA, July 1969.

"Meat Purchasing

"When homemakers buy meat, their first consideration appears to be assurance of good quality, judging by the frequency of replies in a nationwide sample survey in 1967 conducted by the U. S. Department of Agriculture in cooperation with the National Live Stock and Meat Board. None of the four meats focused on in the four-season survey--beef, chicken, fresh pork, or ham--consistently satisfied their requirement among the 3,099 homemakers interviewed.

"When homemakers were shown a list of meats and then asked which meats they might want to learn more about to ensure receiving good cuts, they were somewhat more likely to mention beef and fresh pork, though not to the exclusion of other meats. Some homemakers said they would like more information about selecting all of the meats on the list, although a substantial number expressed no interest in learning more about any of them.

"Complaints about meat in general or the way it is sold tended to concentrate on packaging. Objections were expressed to prepackaging of meats which conceals waste--fat or bone--on the underside where it cannot be seen at the time of purchase. Some homemakers also volunteered that meat is expensive.

"Little interest was expressed in buying meat which is already frozen, even though most homemakers said they sometimes freeze fresh meats at home. Inability to judge the freshness of already frozen meat was most often cited as the basis for reluctance to purchase such meat.

.

"Inspection and Grading

"The functions of government inspection and grading were not altogether clear to respondents. Many assigned the functions of grading to inspection, and vice versa. About half believed that grading of retail meat extends to pork. A majority of homemakers also appeared somewhat confused about USDA grade designations for beef, one example being the impression that USDA Grade A was a familiar designation.

.

"Analysis by Selected Characteristics

"To offset possible seasonal variations in responses due to changes in price or availability of the various meats, the survey was conducted through calendar year 1967. Homemakers' replies indicate that season of the year had no particular bearing on opinions about the meats investigated in this survey.

"For a number of questions, divergent patterns of replies emerged according to the respondents' background characteristics (some of which are closely interrelated, such as level of education, income group, and age). For example, homemakers at higher education levels were more favorably disposed to selecting meats for their nutritional qualities; along with younger homemakers, they were also more interested in learning how to prepare meats and in acquiring new recipes. On the basis of easy digestibility, older homemakers tended to reject ham and fresh pork more frequently in favor of beef and chicken.

"Possibly of even greater interest are topics on which homemakers' responses were not differentiated to any extent by background characteristics. For instance, homemakers with varied backgrounds were almost equally likely to reject the idea of purchasing already frozen meat. They were also generally agreed on the importance of being assured of good quality meat and in their ratings of beef, chicken, ham, and fresh pork in this respect. Large proportions of women--whether at higher or lower levels of education and income--gave evidence of confusion in some areas where factual information was asked for. Substantial proportions at all education and income levels said that pork is graded at the retail level and that USDA Grade A was a familiar grade designation for beef; both responses are fallacies."

VII. PRESENT PRACTICES OF CODE DATING/PUBLIC DATING

A. Voluntary Food Industry Code Dating

When the Consumer and Marketing Service, USDA, services a meat-packing plant at the request of a meat processor trading in interstate commerce, its products, including all sides of beef, and all packages, are stamped with the establishment code number and the statement, "U.S. Inspected and Passed by the Department of Agriculture, Establishment (No.)." The food industry uses voluntary coding of various types on processed meat products and on some retail packaged meats. One chain store (#440FIS), like other retail stores, is

currently expiry dating its packaged fresh meats. On signs, the store states that dating assures freshness. It does not openly tell the consumer on the label what the stamped date represents. On inquiry, the company stated that the date is intended to mean the expiry date of its meats. The company explained that its system was based on experience, packaging material, and handling methods, and that expiration times were arrived at on the basis of color change in the red meats. This color change is one basis on which consumers judge meat purchases. However, the company's system also illustrates the following potential hazards of the dating concept:

- (1) In several instances, members of the survey team observed that dating was apparently unpoliced.
- (2) The label did not clearly inform the consumer about the meaning of the date, i.e., packing date? expiration date?
- (3) Meat products of the most perishable nature, i.e., ground beef, were advanced dated by 3 days, when the company's stated policy on ground beef was that it should only be ground and dated at 1/2-day intervals.
- (4) The malapplied dating system obviously is, in effect, erroneous and deceptive even if unintentionally so. Some foreign countries and the State of Michigan (smoked fish, R285.541.9) legislate against such misleading practices and enforce penalties.

The foregoing hazards are some reasons why the team suggests that public dating/date of expiry not be used on retail meat products unless systems for such are presented to the New Jersey Department of Health authorities and demonstrated as scientifically sound and practically enforceable. The team also recommends the provision of policing to encourage adherence to state policies.

The AMI has established a system of coding for the use of its members. The Institute provided the survey team with Bulletin No. 17, Recommended AMI Meat Code, which the survey team endorses for meat-coding uniformity. Note that the date of promulgation, 1961, is several years old, but the Institute still regards this code system as sufficiently meeting the needs of the industry. Part of this code and the letter of transmittal are provided here with permission of the Institute.

RECOMMENDED AMI MEAT CODE

November 3, 1961

At the last meeting of the Board of Directors of the American Meat Institute, two recommendations were submitted by the Sales and Merchandising Committee.... These recommendations were developed as a result of the study of retailer requests as submitted to our Sales and Merchandising Committee in its contact with the retail representatives at the trade association level. Each of the recommendations was approved by the Board

of Directors, and they are now submitted to the entire AMI membership. It should be noted that on the day following approval by the AMI Board of Directors, the recommendation was submitted to the Supplier-Relations Committee of the National Association of Food Chains and received its support. The recommendations also have been submitted to the Merchandising Committee of the National Association of Retail Grocers and received its approval. They will be submitted to Super Market Institute and other retail trade associations so they may inform their members.

"1. Moved that the Sales and Merchandising Committee recommend to the Board of Directors of the American Meat Institute that the industry in general use the current four-digit AMI Sausage Code (outside digits total for the month, inside digits equal day of the month) on all consumer packages, excluding canned product, whenever a coding is requested and that the code mean a pack date unless it is underlined, in which case it will mean a quality assurance date. (A sale prior to the indicated date will assure customer satisfaction.) It is further noted that this committee does not feel it necessary at this time to include any indication of year in the coding of the aforementioned product."

"2. Moved that the Sales and Merchandising Committee recommend to the Board of Directors of the American Meat Institute that the industry in general, in response to the requests from the retail trade, adopt the practice of open dating on shipping containers whenever a date is used on such a container."

"In connection with the recommendations these points should be stressed:

"1. The current sausage code consists of four digits; the sum of the two outside digits equals the month; the two inside digits represent the day of the month.

Examples: 5214 means September 21
 0219 means September 21
 5036 means November 3

"2 'All consumer packages' means those packages prepared by the packer for sale by the retailer direct to the consumer without need of further processing or wrapping.

"3. The phrase, 'excluding canned product,' is included in the recommendation since such product often carries an indication of the year, and the use of the digit code as recommended makes no allowance for any such indication. Some canned meat processors have indicated they might use the recommended code and add an additional digit to indicate the year. (5214-1 would mean September 21, 1961).

"4. 'Whenever a coding is requested' indicates that this code is optional. Whenever a retailer requests product be coded by the

packer, use of the AMI Meat Code is recommended. To achieve the desired result for retailers who have requested a uniform code, no special code system should be requested.

- "5. The four-digit code is to mean pack date unless it is underlined, in which case it will mean a 'quality assurance' date. In the latter case, the sale of the product by the retailer before the date indicated will mean quality assurance for the consumer. It is not intended that there be any implication of a guaranteed sale in any dating.
- "6. Considerable effort has gone into the possibility of developing a code that would include an indication of the year so that the code might be applicable on a broad food industry basis. The time necessary for gaining approval of such a code would prove to be too long a delay in acting upon the retailer's immediate request for a code on meat. In that light, therefore, immediate action on the four-digit code is suggested.
- "7. The practice of open-dating on shipping containers was requested by the retailers so they might better rotate product in the warehouse as well as at the retail level. Although some consideration was given to using the four-digit code on the shipping container, it was thought best that both in response to the retailers' request and in light of utilization, open dates should be used on the shipping containers."

"Implications

"If you are currently using the AMI Sausage Code there is no need for any change other than to note that the code is intended to mean pack date unless it is underlined, in which case it means quality assurance date.

"If you are currently using a code that differs from the AMI recommended Meat Code you may wish to adopt the recommended code as a service to your retail account.

"If you are currently coding for your own information or using no code at all, you may wish to adopt the recommended code in the event your retail customers should enter a request for coding.

"If your retail accounts are currently using codes of their own on product which you supply and which you are coding for them, they should be informed of the recommended AMI Meat Code as endorsed by the retail food trade. Remind them that their representatives requested a uniform code and that it is now available to them.

"Whenever any retail account requests a packer to place a code on the consumer package the AMI Meat Code is recommended.

"Your support of this program in response to the request of the nation's food retailers will be sincerely appreciated."

Very truly yours,

AMERICAN MEAT INSTITUTE
President

A special survey was recently made by the American Meat Institute of the coding practices of its members to determine its implementation since 1961 and to help this survey. The following results show that of 94 members who responded, 75 used some form of code dates on their packages. Of these, 51 used the AMI code, and 24 used other codes. Note that about 15 percent used no codes.

SUMMARY OF CODE DATING SURVEY BY AMI

Plant Replies: 94

I. Coding system used

	<u>Total</u>	<u>Vacuum pack</u>	<u>Other pack</u>	<u>Canned</u>	<u>Fresh</u>
AMI Code	51	46	38	-	3
Other code (see list)	24	13	17	1	-
None used	14	-	-	-	-
Don't package	4	-	-	-	-
Didn't indicate	<u>1</u>	-	-	-	-
	94				

II. Date represented by code

	<u>Bacon</u>	<u>Lunchmeat</u>	<u>Franks and wieners</u>	<u>Other</u>
Pack date	31	22	33	1
Shipped date	3	5	7	1
Quality assurance date	11	23	22	-
Other (see list)	3	5	4	1

III. Preference

<u>AMI code</u>	<u>Other systems</u>
51	24

LIST OF OTHER CODES AMI

Product is coded according to the "Julian" system, e.g., October 17, 1969 is the 290th day of the year. Product packed on October 17 would be coded 2909--the last number being the year.

Four numerals: first 2, month; last 2, the day. The simple numeral (1020 - October 20) is easily understood and causes less confusion among employees and customers.

One month in advance of date packed.

Number of days per year--1 to 365.

Some chains demand 21 days, some 30. We vary according to customer type.

47-A. Would be the 47th week of year - "A" is the first day of the week.

AMI code on any "quality assurance" product. "Pack date" on shipping cartons and nonassured product.

"Our own system."

Some private label packaging requires actual date of packaging plus 14 days, using 1020 for October 20, for example.

A-3-9--"A" represents month; "3," the day; and "9," the year.

The month and A, B, C, etc., for each day.

Code indicated in manner in which our product is priced--indicates our pickup date.

October 27, 1969.

A major processor (#680FIS) of ready-to-eat packaged meats stated:

"The date-coding system that we employ is that recommended by the American Meat Institute whereby four digits are used, the first and last of which add to the month, and the second and third denoting the day of the month. The date appearing on the package is not the date of manufacture, but is a control date or quality assurance date by which time we expect the product will have passed through retail channels and be in the hands of the consumer. Our quality assurance dates are individually set for each of our products depending upon product keeping time studies and our desire to provide ample time for the consumer to store and use product after purchase."

B. Legal or Required Dating

Dating or coding (establishment code number) is not a general requirement in the United States. However, establishment identification code (USDA number) is a requirement of meat shipped in interstate commerce. This code does not relate directly to quality, and signifies only that the plant is supervised by the Consumer and Marketing Service, USDA.

1. Federal--The Federal Register, April 26, 1969, Part 128--Human Foods; Current Good Manufacturing Practices (Sanitation) in Manufacture, Processing, Packing, or Holding, provides:

"Meaningful coding of products sold or otherwise distributed from a manufacturing, processing, packing, or repacking activity should be

utilized to enable positive lot identification to facilitate, where necessary, the segregation of specific food lots that may have become contaminated or otherwise unfit for their intended use. Records should be retained for a period of time that exceeds the shelf life of the product, except that they need not be retained more than 2 years."

Although an FDA regulation, this provision could well be applied to all meat products presently under the USDA Meat Inspection Program, which does not have such recommendations.

Meats in interstate commerce must be inspected and passed (and given a location code number) by the Consumer and Marketing Service, USDA.

2. State--According to the Wholesome Meat Act of 1967, plants in all States are required to be inspected even when the products are for intrastate commerce. Each State is to adopt into law the requirements of the act within a certain time period.

3. Municipal--No data are available.

4. Foreign--Foreign requirements on code dating/public dating are discussed in the Legal Report, appendix II, "Date Labeling and Related Statutes--Foreign Countries."

C. How the Dating Concept Influences Quality Maintenance
(Advantages and Disadvantages of Coding)

In October 1969, the American Meat Institute made a survey of its members' opinions on dating and its benefits to quality maintenance to help the Rutgers study. An executive of the Institute commented:

"My opinion is that the meat packing industry would be opposed to open dating. I think this is true because of the fact that the date is not the most significant piece of information a person can have about a product, and can actually be misleading because it says nothing about handling. In addition, because of the manner in which consumers select products in self-service counters, some products inevitably will be wasted." 5/

A summary of the Institute's survey is provided, with permission of the Institute.

"COMMENTS ON CODE DATING"
(October 27, 1969)

"If consumers knew codes, product would never be rotated in retail case. Shoppers would search for the freshest and leave a product that

5/ Members of the Rutgers survey team tend to concur with this opinion, and have elsewhere in this report emphasized the necessity of trial dating and other means of testing their recommendations to ensure against food wastage.

was still good, but with older code date. Or the fresher shipment would have to be held back until the older shipment was gone from the display case. I believe the amount of returns would skyrocket in most outlets, and these new costs would have to be added onto our present prices and the consumer would have to pay more in the end. I am against the regulation of codes because I don't think very many people are being hurt now. I do believe that additional shelf life is the answer and the Wholesome Meat Act of 1967 and its enforcement, especially regarding sanitation, will help considerably.

"Code dates should be 'packed date' and set by manufacturers."

"We use the 'quality assurance date' system in all of our coding. We find it much easier to control returned products for credits. We have used the 'packed date' system, but over the long period we have found the Q.A. method worked best for our operation.

"The situation is really getting out of hand--now the customer demands guaranteed sale--out-coded product must be removed and credited.

"Our code date is not a pickup date. It is merely a reference code for us. We pickup on a basis of visual appearance regardless of age.

"Various chains have various ideas on fresh product shelf life. Luncheon meat is coded on expiration date; fresh products could follow a similar procedure.

"Oppose mandatory uniform code dating.

"We service all accounts and strive to see that all packages are returned to our plant upon reaching 'expiration' date. All returned product is rendered 'inedible' and is not brought back into the processing area of the plant.

"We prefer 'pack date.' We use the code date as a check on the merchant in the rotation of his inventory. The monitoring is the responsibility of the salesman. Its effectiveness depends on the efficiency of the salesman.

"We use 'pack date.' We monitor a cross section of accounts from the plant once each week. The salesman is supposed to check his accounts on each call he makes to an account. He is responsible for credits.

"Buyers are responsible for product after they have made the purchase unless the faulty package is a manufacturer's error. We do check cases and rotate stock in some cases, but in other cases the store will not permit any but authorized clerks handling the product.

"We believe it is in the best interests of the meat industry to adopt the Quality Assurance date--AMI code system at the earliest possible time to preclude the possibility of less desirable alternatives which might otherwise be dictated by Government regulations.

"Impossible to check all the stores to see if they are matching their expiration dates. It is left to the store operators.

"We feel that some store managers take advantage and try to return merchandise that is older than it should be."

A major meat processor of ready-to-eat meats (#680FIS) contacted separately by the survey team commented as follows on dating and quality:

"Control Dates vs. Pack Dates"

"The growing popularity of large supermarkets in recent years has placed increasing demands on meat processors to improve the keeping time of their products. As a result, product technology and packaging methods have improved rapidly, and we have been able to meet this challenge through means of improved sanitation, better product refrigeration and advanced packaging materials and methods. It is necessary that all of these factors be practiced and controlled in order to achieve satisfactory and dependable product life.

"In placing a control date or quality assurance date on our products, we are passing a large share of the benefits of improved technology along to our retailers and customers. All such dates are set so as to assure a reasonable length of time for the sale of the item plus adequate time for the consumer to store and use the product after the expiration of the control date.

"It has been our experience that the rotation and movement of our products in stores can be much more easily administered by this system than by working with the date of packaging. The date of pack provides no information regarding the length of time that the manufacturer expects his product to keep. It places the good operator and the careless producer on the same basis and removes much of the reward for maintaining sanitary operating conditions, improving handling methods, developing new packages, and the like."

VIII. FOOD PRODUCT ITEM LIST

A. Shelf Life--Food Industry Sources (FIS)

<u>Food item</u>	<u>Time*</u>	<u>FIS No.</u>
Bacon	14D	30
Bacon (vacuum-packed)	4W	30
Beef, ground	24H	740
Cold cuts	14D	30
Frankfurters	14D	30
Fresh pork	24H	740
Lamb	24H	740
Luncheon meats	14-15D	740
Meat, except ground beef, lamb, fresh pork	3D	740
Pork sausage	14D	30

*W=week; D=day; H=hour.

IX. RECOMMENDATIONS ON BEST MEANS OF FOOD QUALITY MAINTENANCE

The following recommendations were outlined in the Summary of Recommendations (section II):

The date of meat grinding and, perhaps ideally, the time of day should be stamped and clearly identified on the label, and be followed by the statement: "Cook or freeze within 1 day of purchase." It is also recommended that microbial standards be determined and established for ground meats, and that ground meat, if rewrapped when it becomes discolored, be rewrapped with the original date information. Ground meat should be destroyed or sold for inedible, i.e., animal purposes, if it is more than 24 hours old before sale.

Because of the perishability of fresh sausage and the possibility of toxins resulting from infection and growth of staphylococcus aureus, special emphasis should be placed on sanitation in the manufacturing process of sausage. Some form of sale expiration control was considered for recommendation, but owing to probable variations in sanitary procedures from plant to plant, no uniform shelf life or time period can be set. The shelf-life determination is the responsibility of the processor since only he can control all the parameters.

The State of New Jersey should consider the adoption on a voluntary or legally required basis by the processing and distribution trades of the practices set forth in the USDA Sanitation Handbook of Consumer Protection Programs, October 1, 1968.

X. REFERENCES

References for this section are included at the end of the Poultry Group discussion at the conclusion of this chapter.

Fish Products Group

I. INTRODUCTORY REMARKS

Fish is not a main source of protein in the U.S. diet, but is considered as such in other cultures. In the United States, it is generally eaten as an alternative to red meats or for religious or ethnic reasons on certain days or in certain seasons. Figures on the percentage of fish sales in the total supermarket sales are not known.

II. SUMMARY OF RECOMMENDATIONS (see section II of the Meat Products Group above, and section IX in this product group.

III. TYPE OF FOOD AND PRODUCT GROUPS

According to the ASHRAE Guide and Data Book (11), the following major types of fish and shellfish are used in the U.S. market:

- (1) New England: Groundfish (haddock, cod, whiting, flounder, ocean perch), lobsters, clams, scallops, and sardines.
- (2) Middle and South Atlantic: Menhaden, oysters, clams, and blue crab.
- (3) Gulf Coast: Shrimp, oysters, red snapper, clams, and mullet.
- (4) Mississippi Valley and Great Lakes region: Lake herring, chubs, blue and yellow pike.
- (5) Pacific Coast and Alaska: Tuna, halibut, salmon, groundfish, king and dungeness crabs, and oysters.

In addition to the grouping by geographical origin, a classification may be made by pelagic and demersal fish. Pelagic fish, normally found in the middle and surface layers of the sea, include such types as herring, mackerel, salmon, tuna, and anchovies. This group includes many of the fatty fish which, in some instances, contain as much as 20 percent fat.

Demersal fish, usually found at or near the bottom of the sea, include cod, haddock, whiting, flounder, halibut, ocean perch, shrimp, oysters, clams, and crab. These fish usually have less than 5 percent fat and often less than 1 percent fat in the muscle.

Clams, oysters, lobsters, and crabs are normally sold alive to the consumer. (Most lobsters are now imported in parts from South Africa.) "Fresh" seafood is usually sold as dressed fish and fillets. Partially preserved fish include those that are smoked, salted, or pickled. Canned and frozen seafood are discussed under those respective processes.

IV. TYPE OF PROCESSING AND PRESERVATION

A. Practices

The methods of handling seafood after harvesting vary considerably; the choice depends not only on the type of fish, but on the type of fishing equipment used--whether it is small or large, old or modern. No broad generalizations can be made.

Some fish, such as haddock and cod, are usually eviscerated on board ship, washed, and iced. Others, such as ocean perch, particularly because of their small size, are not eviscerated on ship, but are iced. Fresh water fish from the Great Lakes, because of their relatively short haul, are usually not iced; however, those caught in Canadian lakes in summer are iced. Tuna caught off-shore is usually immediately frozen, whereas tuna caught in-shore is usually refrigerated or iced. Shrimp are usually beheaded on board ship, then washed, sorted, and iced, when sold "fresh." A large amount of the shrimp catch is frozen in various forms.

Scallops are shucked at sea, since only the muscle meats are used. They are packed in bags and iced. Scallops receive very little treatment on arrival

at the shore plant. The meats are again washed, drained, and usually packed in 5- and 10-pound waxed cartons, and kept at 35-40°F.

Oysters and clams are kept alive on board ship, generally without ice. Oysters and clams are delivered to the plant alive. After inspection and elimination of dead oysters, the others are washed to remove mud, and are frequently held in running water to which free chlorine is added. Oysters are normally shucked by hand and are then washed in a "blower." They are then held in cool areas for further processing. Those intended for the fresh market are usually packed in cans or glass jars and shipped in ice to the markets. Crabs and lobsters are kept alive in tanks with sea water. Since lobsters and crabs are sold live, there is no processing done except for maintaining proper water supply, or for limited periods an ample supply of wet seaweed.

Curing of fish is accomplished by salting, smoking, and pickling, which preserves fish in two ways. The reduction of moisture content results in decreased bacterial decomposition, and the chemicals added to fish by smoking or pickling further add preservative protection. Salt and some components of wood smoke are among the most significant of these chemicals.

Salting is done in several ways, usually either pickle cured or dry salted. Smoking, while differing somewhat in details of procedure, is basically the process described under smoked meat. Pickled products are made by first curing them in a brine solution containing some vinegar, and then transferring them to a weaker brine solution, but also containing vinegar. They are shipped to the point of sale in this solution.

V. QUALITY CHARACTERISTICS and VI. PROCESSING AND STORAGE QUALITY LOSSES

A. Aesthetic Qualities

The quality of fish and shellfish is judged by the U. S. Fish and Wildlife Service according to standards listed in Fisheries Leaflet No. 428 (12). These standards are as follows:

1. Fresh Fish

- "a. The fish should have bright shiny scales and characteristic colorings and markings. (As the quality of the fish deteriorates, their color and markings fade and become less pronounced.)
- "b. The eyes should be bright, transparent, and protruding. (As the quality of the fish deteriorates, the eyes become sunken and cloudy, and sometimes become covered with a pink slime.)
- "c. The gills should be bright red and clean appearing. (As the quality of the fish deteriorates, the gills usually fade to pink, then to gray, and finally to brown or to dark green.)
- "d. The fish should have a characteristic mild fresh odor and no off-odors. (As the quality of the fish deteriorates, the

odor changes from the characteristic mild fresh odor to a disagreeable off-odor.)

- "e. The flesh of the fish should be firm and elastic. (Fish that have been poorly handled or cared for and that have been held for an extended storage period aboard the vessel exhibit various degrees of soft texture.) Fish frozen at sea and then thawed exhibit, in most instances, the same general characteristics as do fresh fish.
- "f. The fish should show no signs of body damage. (Fish that have not been properly handled may show body damage from rough handling, from fish pews, or from use of too coarse pieces of ice in preservation.)"

2. Shellfish

- "a. Clams should be alive. (A live clam will close its shell when disturbed.)
- "b. Crabs of all species should be alive and active.
- "c. Shrimp should be preserved in ice. They should have a mild characteristic shrimp odor. (Stocks of shrimp with strong off-odors, marked softening of body texture, or severe blackspot discoloration (see item D below) should be discarded.) Shrimp frozen at sea, when thawed, should exhibit the same characteristics as do fresh shrimp.
- "d. Lobsters should be alive and active.
- "e. Scallops are shucked at sea, and only the muscle meats, packaged in bags and preserved in ice, are brought to the shore plant. The fresh meats should have a mild odor. (Stocks with strong off-odors should be discarded.)
- "f. Oysters should be alive. (Live oysters will keep their shells closed when disturbed.) (This industry is under the sanitary supervision of the U. S. Public Health Service, and its inspection codes should be followed.)"

B. Nutritional Qualities

Dassow and McNeely (13, pp. 548-550), in Food Processing Operations by M. A. Joslyn and J. L. Heid, published by The Avi Publishing Co., Westport, Conn., summarized the nutritional value of seafood as follows (used with permission of publisher):

"Nutritionally, fish and shellfish provide excellent food value and variety as a protein source, having about 18 per cent protein in most fish, somewhat lower in oysters and clams, and higher in tuna and salmon. Fat content can be selected for low calorie diets from shrimp, cod, flounder and crab--all about one per cent fat or less. Salmon, mackerel

or tuna canned in oil, and sardines can be selected if a higher fat content of 10 to 15 per cent is wanted. Added nutritional values of fishery products include a desirable balance of essential minerals, the B vitamins and in many species, vitamin A, and a digestibility of 85 to 95 per cent. For low-sodium diets, there are many species of fresh and frozen fish, such as halibut, salmon, and unbrined fillets with sodium contents of 100 mg. or less per 100 gm."

There may be some nutritional losses in fish--generally because of physical effects--which occur between harvest and sale. According to Tarr (14), there are some losses owing to the pressure of top fish on those in the lower areas. There are also some losses due to the "drip" of fluid during dressing, filleting, and other operations, but these are usually economically unavoidable. Curing of fishery products usually results in some protein losses; however, here again, the effect is due to processing and not storage.

C. Microbiological Quality and Health Hazards

As in other protein foods, bacteria are usually the most important causes for deterioration in sea food. These bacteria may come from: (1) the water from which the fish are caught, (2) the fishing vessel, (3) and the shore plant. Since there is such a diversity in sanitary conditions in each one of these phases, the shelf life of fish is virtually unpredictable, and little can be stated except that it is relatively short.

Potter (6) warns about the damage of infection in clams or oysters when they are taken from or near polluted waters, since these shellfish are frequently eaten raw with no heat treatment to inactivate any pathogenic organisms. Sometimes outbreaks of infectious hepatitis occur. This possible danger of hepatitis infections is not related to shelf life and product age; hence, no form of date labeling would prevent any dangerous infection. Commercial plants handling oysters and clams generally operate under State and U.S. Public Health Service regulations.

D. Identification of Potential Causes of Quality Losses

The Fish and Wildlife Service Fisheries Leaflet No. 428 (12) states that:

"Quality loss in fish and shellfish is attributed to one or all of three principal causes: (1) enzymatic or autolytic action, (2) oxidative actions, and (3) bacterial actions. The order of onset for these, and their relative importance in causing deterioration, may vary with such allied considerations as species and maturity, and method used in the capture and in the dressing and icing of fish. The most important cause is generally recognized as bacterial action.

"The chief observed effects of enzyme action are the softening of the fish flesh. In some cases, however, such as herring taken with food in the digestive tract, the autolytic action is so rapid that the belly walls may be pierced and the visceral mass converted to a semifluid state."

Alford and Fieger (15) reported that the spoilage in shrimp, known as "back spot," is enzymatic in nature.

Deterioration in quality can also result from oxidation and rancidity. Fisheries Leaflet No. 428 further states that:

"The oxidation and rancidity of fats can be caused by the single or combined action of tissue enzymes, bacterial enzymes, and exposure to air. The degree of susceptibility among fatty fish varies with species: mackerel, herring, and some of the salmon are quite vulnerable, whereas sablefish are quite resistant....Oxidation, besides causing rancidity, can cause other changes in fish. The fading of pigments that is observed in salmon or ocean perch and the development of off-color, such as in the yellowing of halibut and the browning of haddock, are results of oxidation."

E. Packaging

Fresh fish is frequently not prepackaged for consumer purchase. However, when prepackaged, it is usually done at the retail market. The conventional procedure has been to display the product loosely, in ice. Any prepackaging is usually done in a lightly waxed cardboard tray which is overwrapped with a film of cellophane, polyethylene, or other type of film.

F. Storage and Transportation

The following advice from the ASHRAE Guide and Data Book (11) on fresh fish storage is pertinent (used with permission of the American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc.).

"Total storage life of fish varies from species to species. In general, the storage life of East and West coast fish properly iced down and stored in refrigerated room (35°F.) is about 10 to 15 days, with 15 days as the maximum. This is dependent upon the condition of the fish when unloaded from the boat. Fresh-water fish properly iced down in boxes and stored in refrigerated rooms may only be held for seven days. Both figures are from the time the fish is landed and processed to the time of consumption by the ultimate consumer.

"The storage temperature should not be above 35°F. Ice on the fish serves a two-fold function. The fish must not only be cooled and kept cold, but the surface of the fish must be constantly washed by the water from the melting ice to prevent the concentration of bacteria in the slime from becoming too high. If the ice on the fish is prevented from melting by holding in a storage room at or near the freezing point of water, the bacteria count in the slime will build up to a high level, and the fish will spoil or sour.

"Fresh fish should be stored in a room of low air velocity in order to hold high room humidity to prevent pulling the ice off the fish by sublimation with consequent dehydration of the product.

"When fresh fish is stored in refrigerated rooms by stacking of boxes, the run-off water from the melting ice should drain at the sides of the boxes near the bottom to prevent the solution of slime and ice water from

draining through the layers of fish in the bottom of the pile. Adequate floor drainage must be provided to carry away such run-off water."

VII. PRESENT PRACTICES OF CODE DATING/PUBLIC DATING

A. Voluntary Food Industry Dating

The survey team failed to establish contact with any fish industry representatives.

B. Legal or Required Dating

1. Federal--The fish industry is under the sanitary supervision of the U. S. Public Health Service, but the Fish and Wildlife Service of the Department of the Interior was the main source of information. The following U.S. Federal departments deal with fish, meats, and poultry: Food and Drug Administration, U.S. Department of Agriculture, U.S. Department of the Interior, Fish and Wildlife Service, Bureau of Commercial Fisheries, and U.S. Public Health Service.

Since most fish are in the area of interstate commerce, it seems likely that they are also subject to inspection by the Fish and Wildlife Service. The Service issues many publications and is a major source of information for the fishing industry. There are no U.S. requirements for open or public dating, but code dating may be a requirement. It would seem that the Good Manufacturing Practices of FDA regarding code dating, contained in the Federal Register, April 26, 1969, would apply to fish products. In fact, the Federal Register, October 23, 1969, contains Good Manufacturing Practices applicable to smoked fish with reference to Type E botulism (a food poisoning organism) and consequent possible risks of food-borne infections in the consumption of smoked fish, especially as they apply to current practices of processing technology. On that basis, the Commissioner of Food and Drugs proposed regulations setting forth specific manufacturing practices (sanitation) and requirements regarding processed smoked fish.

Section 128a.7 of the Federal Register states with respect to storage temperatures and coding:

"The shipping containers, retail packages, and shipping records shall indicate by appropriate labeling the perishable nature of the product and shall specify that the product shall be shipped, stored, and/or held for sale at 38°F. or below until consumed.

"Permanently legible code marks shall be placed on the outer layer of every finished product package and master carton. Such marks should show at least the date of packing and the plant where packed."

(Note that no concrete directions for open or cryptic code dating are given.)

2. State and Municipal--Several States have regulations concerning fish that include dating or coding requirements, namely, Michigan, Louisiana, Wisconsin, Georgia, and Florida.

Michigan, Regulation No. 541 Governing Processing, Handling, Storing, Labeling, and Advertising for smoked fish states under R285.541.7 Labeling 1(d) the following requirements:

"(d) Lot code number that identifies period when processed and packaged, as required in Rule 2.

"(e) Warning statement 'Perishable--Keep under refrigeration at 36°F. or below.'

"(f) Warning statement 'Not to be sold or consumed after _____,' the blank to be filled with date including month, day, and year, this date to be not more than 14 days after date of smoking.

"(2) The labeling requirements for frozen smoked fish are the same as for unfrozen smoked fish with the exception of (e) and (f) above. These statements shall be replaced with the warnings: 'Perishable: Keep frozen. Thaw in refrigerator,' and 'After thawing, keep refrigerated at 36°F. or below.'

"(3) All label statements shall appear in a conspicuous place in a distinctive and plain manner, in plain English words and numerals. All statements shall be permanently affixed to each separate and distinct package or container."

(Note that the foregoing is open public expiry dating.)

Further, under R285.541.9 Transfer of Date Code Prohibited, Rule 9 states:

"No smoked fish product shall be sold under any expiration date code other than the original expiration date code the processor assigned to the product."

Louisiana, Sanitary Code, Chapter VI, Marine and Fresh Water Animal Food Products (Seafoods), states under Revised Statutes of 1950, Title 40, as amended:

"6.14 Shipping Requirements. The shipping of shucked shellfish, picked crabmeat, cooked, peeled shrimp or other marine or fresh water animal food products to be consumed without further cooking or processing, shall comply with the following requirements:

"6.141 Such products shall be sorted and shipped under such temperature conditions as will prevent spoilage. Outside containers shall be provided for ice, and no ice or other foreign substance shall be allowed to come in contact with the products during shipment or storage. (It is required that shucked stock be kept at a temperature of 50°F., or below, from the time it leaves the shipper until it reaches the consumer, but

that it be not allowed to freeze except where freezing processes approved by the State Board of Health are employed.)

"6.142 Such products shall be packed and shipped in approved containers sealed in such manner that tampering is easily discernible, and marked with the packer's certificate number impressed or embossed on the side of such container and preceded by the letters 'La.' when packed in Louisiana, or by the abbreviation of the State in which packed. When containers are sealed with covers which become an integral part of the container and which will ordinarily be removed only by the ultimate consumer, the identification number and letter may be impressed in or permanently embossed, lithographed, or printed on the cover instead of on the side of the can. The date when such containers are filled shall be impressed in the cover by the packer, either in code or uncoded. If the date is in code, a key to the code shall be supplied the State Board of Health of the State in which the shellfish are packed, and to the Surgeon General of the U.S. Public Health Service. Shipments shall be so tagged or labeled as to show the name and address of the consignee, the name and address of the shipper, the name of the State of origin, and the certificate number of the shipper. (Underscoring added by survey team.)

"6.143 Use of containers bearing the certificate number of another shipper shall not be permitted. Shellfish, if repacked, must be properly labeled to show point of origin and the certificate number of the original shucker and packer."

(Note that the dating of fish may be either open date or cryptically coded.)

Wisconsin, Department of Agriculture, Chapter Ag 46, Smoked Fish Processing Plants, Ag 46.09 and 46.10 state:

"Ag 46.09 Labeling. All sale containers, whether consumer-sized or bulk, shall be labeled to show:

"(1) Name and address of processor or distributor.

"(2) Name of product, including common species name of fish from which product is derived.

"(3) Net weight of contents.

"(4) The words 'Perishable--Keep Refrigerated' in conspicuous letters.

"(5) Date of processing (day and month).

"History: Cf. Register, August, 1965, No. 116, eff. 9-1-65.

"Ag 46.10 Restrictions. (1) Smoked fish may not be sold subsequent to 14 days after date of processing.

- "(2) Smoked fish shall have a salt (sodium chloride) content of not less than 5% in the water phase. Salt content shall be determined on the edible portion of back muscle (loin), excluding bones and skin.
- "(3) No smoked fish shall be sold under any processing date other than the original processing date assigned by the processor. Smoked fish held beyond 14 days subsequent to processing date shall be immediately removed from sale and immediately destroyed or treated so as to render it unfit for human consumption.
- "(4) No smoked fish may be sold or offered or exposed for sale in this state unless such product has been processed, refrigerated and labeled in accordance with the requirements of this chapter.
- "(5) No person shall sell smoked fish at retail from a bulk container unless a sign or counter placard is displayed at the point of sale bearing the words 'Perishable--Keep Refrigerated' and bearing all other label information required to be shown on the sale container, except that net weight is not required on the counter placard if net weight is determined at time of sale."

(Note the following: (1) While an expiry time is specified, i.e., 14 days at refrigeration, the refrigeration temperature is not specified; (2) the open date of processing only is required; (3) the consumer is not informed that she should use the product within a specified time; and (4) the person or persons responsible for removal and destruction of the product are not specified.)

Florida, Chapter 170C-19, Shellfish 170C-19.08 Container Identification states:

"170C-19.08 Container identification--

- "(1) Shucked shellfish container.--packers or repackers certificate number preceded by state abbreviation will be embossed, imprinted, lithographed and otherwise permanently recorded readily visible on the body of containers or on the cover if cover becomes an integral part of container during sealing process. (Example: Fla.-872). Containers shall indicate type of product, quality, name and address of packer or repacker. Packages of frozen shellfish shall show date or code of packing. Repacked shellfish containers shall bear actual date of repacking and an appropriate code in order to retain the identity of original packer.
- "(3) Shellfish identification, out-of-state.--no shellfish from sources outside the state shall be brought into the state for purpose of resale or public distribution unless product bears evidence of certification from its state or nation based on similar requirements outlined in this chapter."

(Note that open or cryptic code dating is "required" and there are the same "requirements" on out-of-State products.)

"(40-35-44) Sale of Oysters. Oysters must be sold in the original container showing certification number, name and address of packer; except for retail sale when dipped from the original container in presence of the customer."

"(40-35-43) Refrigeration...(C.) No fowl, shrimp, fish, oysters or other seafood products shall be labeled 'FRESH' that have been frozen."

3. Foreign--Foreign dating requirements are covered in appendix II.

C. How Dating Influences Quality Maintenance: Advantages and Disadvantages of Dating

Obviously, the delicate nature of fish (discussed in section IV, Type of Processing and Preservation) is recognized by Federal and State governments. The types of dating discussed above are beneficial and need to be applied generally and to all States to protect against public health hazards.

VIII. FOOD INDUSTRY SHELF LIFE

Other data for this section are provided in section VIII of the preceding Meat Product Group. The following tabulation shows times and temperatures for some fish:

Stability of some fish products

Approximate number of days
remaining in good condition--

<u>Product</u>	<u>At 32°F.^{1/}</u>	<u>At 60°F.</u>
Fresh cod	14	1
Fresh salmon	12	1
Fresh halibut	14	1
Finnan haddie	28	2
Kippers	28	2
Salt herring	1 yr.	3-4 mo.
Dried salt cod	1 yr.	4-6 mo.

^{1/} Assuming fish are immediately iced and never allowed to warm up.

IX. RECOMMENDATIONS ON POSSIBLE MEANS OF FOOD QUALITY MAINTENANCE

Despite the relatively high degree of perishability of fresh seafood, there is no firm basis for advocating general mandatory dating except on smoked fish products, in which open public expiration dating (based on a 14-day refrigeration--less than 40°F.--shelf life) is required for prevention of public health hazards. The great variability in sanitary conditions that

exist from the time of catch to the time of sale is part of the rationale behind such a recommendation. A further deterring factor is that much fresh seafood is sold unpackaged. There is, however, basis for recommending that codes of practices for handling all fish--fresh and frozen--be established and enforced by the New Jersey Department of Health. (Note that frozen fish are essentially excluded from the following statements which apply to fresh or sea water fish.) In general, the producer is in the best position to establish how much shelf life can be expected from his product, including a reasonable time for customer storage. If producers believe that open expiry dating would be of a precautionary benefit to them and of benefit to consumers, they should be encouraged to voluntarily establish expiry dating for fresh fish. In the State of New Jersey, in lieu of this, we recommend that all fresh fish sold at the retail level, particularly when packaged, should be labeled "Keep refrigerated (38°F.) or below; use within 24 hours of purchase." To protect against temperature rise in fish in store-to-home transportation, freezer bags should be used for the final wrapping of fresh fish. In fish markets with unpackaged fish, placards with instructions that the product be kept under refrigeration (38°F. or lower) and consumed within 24 hours of purchase would seem to offer some beneficial protection to consumers.

X. REFERENCES

References for this section are at the end of Poultry Products Group discussion which follows.

Poultry Products Group

III. TYPE OF FOOD AND PRODUCT GROUP

Included in this product group are chickens, turkeys, ducks, and geese. The following poultry product categories and varieties are found in retail markets: (1) fresh whole, eviscerated; (2) frozen whole, eviscerated (see discussion on Frozen Foods; (3) poultry parts; and (4) processed poultry--chicken and turkey rolls.

IV. TYPE OF PROCESSING AND PRESERVATION

A. Practices

The operations used in preparing fresh, whole, eviscerated chickens for the consumer market illustrate the practices and processing of other types of birds. Chickens used for the present day market are from selected strains, raised specifically for their meat value. Market classifications are generally based on age and live weight. The following designations, from younger to older, are usually: broiler/fryer, roaster, capon, and stewing chicken. Tenderness generally decreases from the smaller and younger to the larger and older birds.

The major steps usually followed in processing are: Slaughter, carcass preparation, inspection, packaging, and shipping. Chickens are usually chilled

to 35°F. or lower in ice slush as quickly as possible. Chilling is an important step since it influences shelf life. Slush ice is frequently used, but modified techniques have been developed. USDA regulations specify maximum allowable time to reach the required temperature for various weights of chickens. At this stage, some water may be absorbed, which increases the weight artificially. The amount of absorbed water is limited by law. After draining, the chickens are usually packed in crushed ice, in wax coated cartons or boxes. It is necessary to keep these boxes at below 40°F. until sold and used. Storage and shelf life depend on the original bacteria load. Sanitation is, therefore, a controlling factor in the storage life of fresh poultry.

USDA inspection standards are applied to poultry processing and products intended for use in interstate commerce in a way similar to that applied to meat. The processing operations are under the direct supervision of USDA inspectors, who are responsible for the wholesomeness of the products. Each plant is identified by a plant number, which must appear on the inspection stamp on each package.

The Consumer and Marketing Service, USDA, provides a grading service, use of which is optional, even in interstate commerce. Inspectors grade the poultry as: Grade A (#1), Grade B (#2), and Grade C(#3). This grading is for quality and is based on residual pinfeathering, shape, fleshing, fat, and freedom from physical handling defects.

B. Poultry Parts

Poultry products, such as chicken legs, are prepared by simply cutting up the parts, packing them in the conventional retail (cardboard or plastic) trays, and overwrapping them in film. Chicken livers, which are also sold as separate poultry parts, are prepared in the same manner.

Because of the larger surface area of poultry parts and the additional handling required, strict sanitation practices are at least--if not more important--for these products than for whole chickens.

C. Processed Poultry

Chicken and turkey rolls are prepared from cooked, deboned chicken or turkey. The meat, in some instances, is mixed with a binder such as gelatin, and shaped in a cylindrical form.

V. QUALITY CHARACTERISTICS and VI. PROCESSING AND STORAGE QUALITY LOSS FACTORS

A. Flavor and odor of poultry products are directly affected by storage temperature, the beneficial effect of which is, in turn, based on the original degree of sanitation and that practiced throughout the life of the product. Hence, good refrigeration (38°F.) practices should be observed throughout poultry processing and storage. Deterioration of acceptable good flavor and

odor is likely to take place as bacteria populations grow significantly.^{6/} The appearance also changes, which is especially noticeable by the development of slimy surfaces, as deterioration occurs. Texture is normally expressed as tenderness. Besides age of the bird, one major factor is the natural enzymic tenderization which takes place after rigor mortis subsides. In normal distribution channels, with poultry from large packing houses, this change has taken place by the time the consumer uses the bird. Another factor is the scald temperature, which is not related to storage time. High-scald temperature, while possibly facilitating feather removal, causes some skin toughening when compared with lower scalding temperatures.

Bacteria growth is the principal cause of shelf-life termination of poultry. If there are about 10,000 bacteria per gram on the surface when processed (a common count), odor and slime can develop in about 6 days, even at 40°F. Figure 3 illustrates this point.

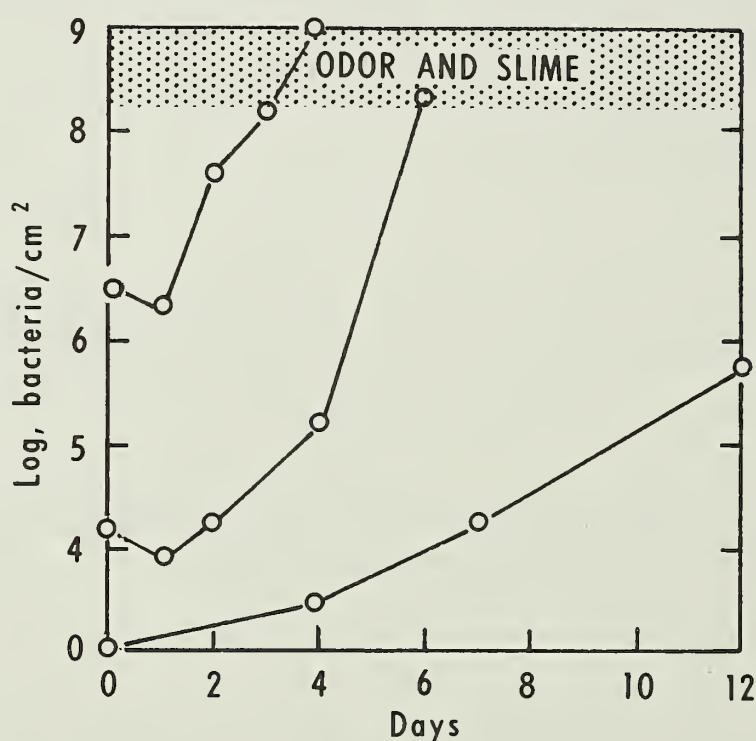


Figure 3.--Effect of initial bacterial load on shelf life of chicken meat at 40°F.

Source: Elliott and Michener, and data of Ayres, et al. (9).

^{6/} W. J. Stadelman (18) describes a patented poultry processing scheme which extends the time of detection of off-odors by "12 days or about 40%." He points out that such techniques will require major plant, transportation, and retail display equipment changes to achieve the lower 28°F. temperature and that the scheme is applicable to other uncooked meats. The author states that utilization of such temperatures could lead to ". . . a new family of convenience foods to utilize the space," i.e., 28°F. storage space.

Normally, any sizable bacteria populations are likely to be reduced to a small number or zero during the cooking process to which poultry is virtually always subjected before eating. However, one possible health hazard is the possibility of toxin development by large populations of staphylococci, which would withstand the normal cooking process. Salmonella bacteria may also be present in some poultry.

Although these organisms are most likely to be destroyed during normal cooking, the possibility exists of the consumer contaminating other products in the home by cross contamination. For instance, should the raw chicken contain substantial numbers of a pathogenic organism, and the homemaker, in preparing the bird for cooking, contaminates the cutting board or her hands, or both, and then proceeds to handle other foods without first washing her hands, these other foods, if they are highly perishable salads or poultry dressings, could be a potential source of future food poisoning. This situation, however, has nothing to do with product storage or dating.

C. Nutritive Value

The following quotation by N. N. Potter from Food Science (6), published by The Avi Publishing Company, Westport, Conn. (used with permission of publisher), describes the nutritional value of poultry as follows:

"The composition of the edible parts of chicken depends upon the cut and the method of cooking. Roasted white meat without the skin will contain about 64% water, 32% protein, and 3.5% fat. Roasted dark meat without the skin contains about 65% water, 28% protein, and 6% fat. The skin is higher in fat. Chicken flesh contains more protein and less fat than red meat. The protein is of excellent quality and contains all of the essential amino acids needed by man. . . . Like other animal tissue, poultry flesh is a good source of B vitamins and minerals."

D. Transportation, Storage, and Display

Whole, eviscerated carcasses are generally shipped in wood crates with wax paper liners or in moisture proof, wax-coated paperboard cartons. The chickens are packed in ice to keep their temperature at or below 35°F. At the retail store, the chickens are either sold whole, or cut up into parts, packed in trays, and wrapped in transparent film. Prolonged storage below 32°F. is said to cause "burn"; however, limited usage of 30-31°F. storage has been shown to extend the shelf life.

VII. PRESENT PRACTICES OF CODE DATING/PUBLIC DATING

A. Voluntary Food Industry Code Dating and Monitoring

The survey team failed to contact any member of the poultry products processing industry, and thus can present no data on the matter. It appears to be a very complicated and difficult problem.

B. Legal or Required Dating

1. Federal--There are no Federal requirements for public dating of poultry products. According to FDA regulations contained in the Federal Register, April 26, 1969, Good Manufacturing Practices, the FDA seems to want code dating for interstate and intrastate commerce shipments. The Wholesome Poultry Products Act of 1969 may have requirements in this area, but it was not studied by the survey team.

2. State and Municipal--There are requirements for dating of products under the "cold storage acts" of various States (see Legal Report, appendix I).

3. Foreign--Dating requirements for poultry are not specifically made, but can be expected to exist (see Legal Report, appendix II).

VIII. FOOD PRODUCT ITEM LIST

A. Shelf Life--Food Industry Sources

No food industry data were available on poultry.

B. Shelf Life--Scientific Sources

Shelf life depends not only on the storage temperature but also to a very great extent on the initial bacterial contamination (see figure 3). Because of these variables, no specific shelf life can be established. Under good processing conditions, however, fresh eviscerated chicken can remain acceptable for about 1 week from time of processing to time of consumption.

IX. RECOMMENDATIONS ON BEST MEANS OF FOOD QUALITY MAINTENANCE

A. Through Dating/Coding

On the basis of the foregoing information, a specific expiration date cannot be established for poultry because of the many variables affecting the period of salability. Such dating would require monitoring by the specific retailer to determine conditions applicable to his operation.

X. REFERENCES

- (1) Chain Store Age, 1969 Supermarket Sales Manual, Lebhar-Friedman, Inc., New York, N.Y., July 1969.
- (2) Brissey, G. E., and Goeser, P. A., in Food Processing Operations, by M. A. Joslyn and J. L. Heid, The Avi Publishing Company, Westport, Conn., 1963, p. 601.
- (3) Urbain, W. M., in The Chemistry and Technology of Food and Food Products, by M. B. Jacobs, John Wiley & Sons, Inc., Interscience Publishers, New York, N.Y., 1951, p. 601.

- (4) American Meat Institute, Circular 2, Chicago, Ill.
- (5) Schweigert, B. S., and Lushbough, C. H., in Nutritional Evaluation of Food Processing, by R. S. Harris and H. von Loesecke (eds.), John Wiley and Sons, Inc., New York, N.Y., 1960, p. 262.
- (6) Potter, N. N., in Food Science, The Avi Publishing Company, Westport, Conn., 1968, pp. 389, 396, 415.
- (7) Brennan, M. J., "Factors Influencing Consumer Purchases of Packaged Fresh Meat in a New Jersey Supermarket," unpublished data, 1966.
- (8) _____, "Processed Meat Packaging," Rutgers Meat Science Institute, Rutgers University, New Brunswick, N.J., 1967.
- (9) Ayers, J. C., et al., "Post Mortem Changes in Stored Meats, I. Micro-organisms Associated With Development of Slime on Eviscerated Cut-up Poultry," in R. P. Elliot and H. D. Michener, Psychrophilic Micro-organisms in Foods, Technical Bulletin No. 320, U.S. Department of Agriculture, 1965.
- (10) American Meat Institute, Publications List, Chicago, Ill.
- (11) American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc., ASHRAE Guide and Data Book, Applications for 1966 and 1967, New York, N.Y.
- (12) U.S. Fish and Wildlife Service, Fisheries Leaflet No. 428, U.S. Department of the Interior, Washington, D.C.
- (13) Dassow, J. A., and McNeely, R. N., "Commerical Fishery Methods," in Food Processing Operations, by M. A. Joslyn and J. L. Heid, The Avi Publishing Company, Westport, Conn., 1963, pp. 548-550.
- (14) Tarr, H. L. A., "Effects of Processing on Fish Products," in Nutritional Evaluation of Food Processing, by R. S. Harris and H. von Loesecke (eds.), John Wiley and Sons, Inc., New York, N.Y., 1960, pp. 283-300.
- (15) Alford, J. A., and Fieger, E. A., "The Non-microbial Nature of the Black Spots on Ice-Packed Shrimp," in Food Technology, No. 6, June 1952, pp. 217-219.
- (16) General Services Administration, Office of the Federal Register, United States Government Organization Manual, 1969-1970, Washington, D.C.
- (17) Progressive Grocer, Consumer Dynamics in the Supermarket, New York, N.Y., 1966.
- (18) Stadelman, W. J., "28 to 32°F. Temperatures Ideal for Preservation Storage and Transportation of Poultry," ASHRAE, March 1970.

BAKERY PRODUCTS AND SUPPLIES

I. INTRODUCTORY REMARKS

Bakery products are one of the main sources of carbohydrate and sometimes protein in the diet. Bread and rolls contain more protein than do cakes and other products in this grouping. They are a complement to the three main meals of the day and to many between-meal snacks. Enrichment of especially standardized bakery products, when practiced, makes such foods an important source of vitamins as well as carbohydrates and proteins in the diet. Their quality losses are mainly of the aesthetic type, staling being the primary one. Most products in this department are "pasteurized" by the baking they receive and their aging does not present a potential health hazard. However, fillings and decorations, e.g., eggs, cream, and dairy products, added after cooking contain ingredients which may harbor pathogenic bacteria.

II. SUMMARY OF RECOMMENDATIONS (see also section IX)

A. Adoption by the New Jersey Department of Health of the Coding Recommendations of the FDA Good Manufacturing Practices, Federal Register, April 26, 1969, for processed foods. Disclosure of code meanings by food manufacturers to the New Jersey Department of Health on request by the latter.

B. Adoption of the open date of manufacture labeling for all outer cases/overwraps, etc., to assist in stock rotation. Bread, which is delivered and rotated on a daily basis, should be an exception to this recommendation.

C. Voluntary coding of all individual containers in such cases/overwraps by the food industry with codes of its own choosing (similar in intent to item A. above). Such codes should indicate plant location, date of manufacture of the final product and its container, shift, production line, and any other aspects of products, at the manufacturer's discretion.

D. Stamping of date of shelf display by retail store clerks for stock rotation, and as a consumer aid in home storage stock rotation.1/

E. Expiry dating of products by all manufacturers of refrigerated dough items with a statement on the label, "For best results use before date on end of package."

F. Establishment of regulations for sanitation, handling practices, and microbiological requirements for cakes with dairy-based fillings to avert potential health hazards. Such products should be refrigerated at all times during production up to final consumption. Dairy and synthetic cream-filled

1/ Bread should bear the date of shelf display via a color coded tie, tag, or label. The code meaning should be clearly displayed.

eclairs, cream-layered cakes, and pies of similar composition should carry instructions to "Refrigerate at all times and consume within 24 hours of purchase." Other pies should carry the instruction, "Refrigerate after opening."

III. TYPE OF FOOD AND PRODUCT GROUPS

Bakery products and supplies, by product group, category, and variety

Product group	Percent- age of total sales	Product category	Percent- age of category sales	Percent- age of total sales	Product variety	Percent- age of depart- ment sales	Percent- age of total sales
Bakery foods	4.61			4.61			
Cookies and crackers	2.32			2.32			
Snacks (packaged)	1.08			1.08			
Premixes and bakery supplies	.97	Chocolate	11.4	.111			
					Chips	7.2	.070
					Baking	2.7	.028
					Cocoa	1.5	.013
						<u>11.4</u>	<u>.111</u>
		Bread stuff- ing and crumbs	6.1	.060			
		Coconut	3.2	.031			
		Cake frosting	2.1	.021			
		Cake and cookie dec- orations	1.6	.015			
		Dry yeast	1.1	.010			
		Cornstarch	.5	.005			
		Misc. baking needs	3.2	.031			

Source: Chain Store Age, 1969 Supermarket Sales Manual (1), Lebhar-Friedman, Inc., New York, N.Y., 1969. Used with permission of publisher.

Product group	Percent- age of total sales	Product category	Percent- age of category sales	Percent- age of total sales	Product variety	Percent- age of depart- ment sales	Percent- age of total sales
		Cake mixes	29.8	.291	Chocolate and Devil's Food	6.1	.060
					Yellow	5.6	.054
					White	3.5	.034
					Spice/ginger- bread	2.1	.021
					Angel food	2.1	.021
					All other cake mixes	10.4	.101
						29.8	.291
		Other mixes	41.0	.399			
			100.0	.974			
					Biscuit, bread, cornbread	8.5	.083
					Pancake	8.2	.080
					Cake frosting	7.7	.075
					Brownie, cookie, bar	7.0	.067
					Muffin and sweet bread/rolls	5.3	.052
					Pie crust	4.0	.039
					Misc. mixes	.3	.003
						41.0	.399
Flour	.29	White	85.7	.248			
		Cornmeal	10.7	.031			
		Cake	1.8	.005			
		All others	1.8	.005			
			100.0	.289			
Refrigerated doughs	.33	Biscuits, donuts, etc.		.328			
Total	9.60						

IV. TYPE OF PROCESSING AND PRESERVATION

The bases of preservation of the products in this major department are mixing of dry ingredients with water and panary fermentation, followed by heating in shaped containers to fix the aesthetic shape of the products. After baking, the product, which is now of low-moisture content, may be heightened aesthetically by the addition of fillings, icings, or decorations before final consumer packaging. The various processes used are too diverse to be discussed here. Many books and scientific and technical journals are readily available and can be consulted for such information.

V. QUALITY CHARACTERISTICS and VI. PROCESSING AND STORAGE QUALITY LOSS FACTORS

The quality characteristics of importance identify potential loss areas and are those causes of quality loss which are exemplified by deteriorative processes in the products discussed below.

A. General Quality Losses

1. "Staling" of the bread or cake crumb occurs in the form of apparent drying, increasing firmness, and crumbliness.
2. Flavor changes and general loss of characteristic flavors associated with freshness.
3. Rancidity owing to oxidation of fats.
4. Mold development.
5. Bacteriological spoilage, including souring.

B. Additives

Common additives, which are not necessarily basic ingredients but are frequently used, include:

1. FDA-approved chemical preservatives and additives to prevent occurrence of items 1, 3, 4, and 5 above.
2. Nutritional additives, vitamins, and minerals to replace those lost during flour milling or bleaching, and protein supplements such as lysine to make bread more nutritionally complete.

C. Product Handling Procedures and Storage Changes for Quality Maintenance

1. Bread and rolls--In the first few hours after baking, noticeable flavor and texture changes take place. Acceptable products are marketed 1 or 2 days later, depending on formulation, wrapping or packing, and handling procedures. Apparent drying is not necessarily the result of moisture loss alone, which is critical, but more importantly because of changes in the starch

in the bread. Appropriate wrapping keeps the product clean and minimizes moisture loss, and thus retards drying.

As moisture evaporates from the bread, it is retained inside the wrapper, causing the relative humidity inside the wrapper to rise to 75 percent or higher. This RH level percentage is conducive to mold growth. Consequently, mold inhibitors are quite generally used in wrapped bread. Frequently, FDA-approved calcium and sodium propionate is used. These preservatives retard but do not prevent mold growth and extend shelf life during distribution and consumer storage. Normally the storage of white bread does not pose any health hazards.

Rolls, both hard and soft, generally behave like bread. Hard rolls lose crustiness with storage inside a wrapper. Mold growth can occur during storage inside a package or a wrapper, especially during warm, humid weather.

The storage life of all items in this group varies considerably, but with the exception of rye bread, does not result in health hazards. Some rye bread mold spoilage has been found to be toxic (possibly ergotism).

2. Cakes--The staling tendency of cake products varies considerably, with those higher in shortening content showing a slower rate of apparent drying and crumbling. Like bread, there is generally no health hazard from the crumb portion due to storage, but FDA-approved mold inhibitors may be used. Some FDA-permitted additives such as emulsifiers are used to extend softness and freshness from 1 to 4 days. The various types of fillings and icings, discussed below, limit shelf life and storage conditions.

a. Fillings and Icings

(1) Custard types: The older type products made with eggs, with or without milk or cream, have traditionally been used as fillings for some types of cakes and for eclairs and cream puffs. Products containing such fillings are potentially hazardous because they may contain pathogenic bacteria and therefore require extreme sanitary care during preparation and adequate refrigeration throughout all stages of storage and transportation until consumption. These products should always be kept below 50°F. and preferably below 40°F. This is necessary because they contain nutrients for bacteria of both harmful and harmless types. Hence, if contaminated or improperly handled, such products may be a health hazard. Age since manufacture is another factor in determining whether such products are health hazards. Dating of such a product could cause a serious false sense of security by designating as usable a potentially dangerous product which has been particularly mishandled. Handling, sanitary practices, and temperature maintenance are factors that should be established and enforced.

(2) The synthetic cream type fillings,^{2/} having somewhat similar textural consistency to that of the egg types in item a above but not

^{2/} An industry source (#45FIS) stated, "Regular cream fillings for cream filled products are produced with sugar/water ratio which will not support growth of pathogens at room temperatures or at elevated room temperature."

containing eggs or cream are frequently sold to the baking trade as being "safe" to use and store in finished product form at room temperature. These formulations vary considerably in composition as well as in the supplementary ingredients added during preparation for use. Some formulations and combinations may support considerable bacterial growth (while others do not readily support growth) and products containing them could constitute health hazards, especially if unsanitary handling conditions are involved. To protect these products adequately, it is safest to store all of them at 45°F. or below (2). While deterioration depends on time, other factors dominate over time alone, i.e., temperature, etc., making open dating or expiration dating of little value.

(3) Fruit or fruit-flavored fillings generally do not constitute a health hazard by being kept at room temperature. They may spoil by yeast fermentation if their solids content is too low or by mold development. They are best stored under 40°F.

(4) Nuts may become rancid or develop insect infestation. These reactions do not occur during the usually brief period from production to consumption, but most likely began before the ingredients were incorporated into the complete product.

(5) Other types of fillings include fudge, sugar icings, marshmallow, etc. They do not constitute health hazards during storage, although mold may form or fats may become rancid. Usually these problems are solved by controlling the process, formulation, and pH by adding FDA-approved inhibitors and antioxidants, by proper adjustment of the moisture content, etc.

b. Loaf cakes, pastries, and buns are subject to conventional staling and possible mold growth but do not constitute a health hazard due to normal storage.

c. The deep fat fried cakes, which include doughnuts and crullers, are classified like the foregoing ones as far as stability is concerned, except for those which have some form of real or synthetic cream-type filling. The remarks in items (1) through (5) also apply here.

d. Eclairs, cream puffs, and their modifications are limited by the fillings they contain. The remarks in items (1) through (4) also apply here.

e. Fruit cake is rather stable and can be kept many months without loss of quality. Possible changes in quality which may limit the storage life include development of mold, development of rancidity of nuts, and development of insect infestation, probably originating in nut meats and fruits such as raisins. A manufacturer (#45FIS) stated:

"All ingredients are microbiologically analyzed. They are cooled after baking in special rooms supplied with temperature controlled and filtered air to reduce mold infection which is the most serious hazard for this product."

f. Cheese cake varies widely in composition and is usually perishable. Spoilage may take the form of mold growth as well as bacteriological spoilage. Refrigerated storage is therefore required.

In all the foregoing products, the deteriorative changes do not universally occur but may show up depending on the precautions taken by the processor. These changes may never occur. Obviously, since formulation, processing, handling, distribution, display, and consumer storage procedures are not standardized, great variations can take place.

3. Pies--Pies may be divided into two groups: fruit-filled and nonfruit-filled.

a. Fruit-filled--The fruit-filled pies generally do not constitute a health hazard owing to storage because the pH of the fillings is low enough to prevent bacteria growth of pathogenic food poisoning types. Occasionally, mold growth can take place during storage, but this is only a possibility and not a general likelihood. The pies are made from fruit ingredients that are fresh, frozen, dehydrofrozen, or dehydrated, and one or more sweetening agents such as cane or beet sugar, corn syrup, or corn sugar, or a combination of any of these.

The most common thickening agent is some form of starch or modified starch. Occasionally, one of the natural or synthetic gum gelling agents may be added for desirable textural or appearance effects.

The fillings may be cooked or uncooked. In the cooked types, sufficient heat is used to cook the starch ingredient so that it gels and becomes clear. In the uncooked type, pregelatinized starch is used so that no heat is applied during the processing and assembly operation, but only during the final baking.

b. Nonfruit-filled--The nonfruit fillings cover a diversified assortment and include custard, cream, parfait, and others. These have varying degrees of perishability depending on the type, the combination of ingredients, and the method of operations of the particular manufacturer, and whether intended for refrigeration or frozen storage.

Custard-type pies such as coconut custard and pumpkin, which contain eggs or egg yolks and milk, are heated sufficiently during baking to cause the filling to "set." This temperature is sufficient to provide a pasteurizing effect and to kill pathogenic bacteria. However, if kept under warm conditions during storage this type may become sour and bacteria may multiply. Refrigeration is a normal requirement. Similar type pies which do not contain eggs as the thickener are less apt to spoil when abused.

Cream pies containing regular dairy products are subject to spoilage if not refrigerated. Those made with substitute dairy products may have varying degrees of greater stability, but individual judgment can again be made only on the basis of each manufacturer's formulations and practices.

Starch-based pies such as chocolate pie may contain a cooked filling which is relatively stable, or one made with pregelatinized thickening

agents which require little or no heat and may thus have greater perishability. Such pies may be topped with whipped cream, the perishability of which is well known, or with one of the many types of substitutes which provide varying degrees of stability.

Parfait-type pie fillings are normally whipped and may contain gelatin or one of the numerous other whipping agents. Perishability again depends on formulation and manufacturing practices.

In general, pies vary greatly in perishability unless preserved by freezing. As noted above, shelf life varies greatly, but usually only lasts a few days. Some products necessitate refrigeration; for some it is advisable; and others do not require it.

During normal storage time, there are numerous instances in which mold may develop in either the filling or crust of some of these pies. This is not necessarily an indication of carelessness on the part of the manufacturer. Where legally permitted, FDA-approved mold inhibitors are sometimes used. Pie crusts normally have a relatively high shortening content; consequently, rancidity may develop. However, storage times are usually not long enough for this to occur, provided that the raw materials from which the pies were made were of suitable quality at time of manufacture. Antioxidants where permitted by law are sometimes used in the original shortening or in the pie crust itself.

4. Cookies and crackers--Because of their generally low-moisture content, cookies and crackers normally do not present a health hazard owing to storage. Because of the wide diversity in composition further generalization cannot be made of this group as a whole. Crackers, the lowest moisture group, can be stored in suitable packets for several months without noticeable deterioration.

Cookies vary considerably in moisture content and fillings. Those that are soft are likely to become unsalable if they become dry and hard. Protective packaging is used to extend shelf life. Fillings ordinarily used in cookies deteriorate very slowly and cause no health hazard owing to storage. Crackers and cookies, which must be texturally crisp, may become soft if stored in humid areas. This is minimized or retarded by appropriate packaging. The softening and breakdown in texture are not the result of progressive aging but are solely because of prevailing storage conditions.

Cookies containing oxidizable fats may become stale or rancid if not protected by antioxidants. Such rancidity can be rapidly accelerated if transparent packages are exposed to sunlight or artificial light sources, even if for a short time. This type of product abuse is not normal and has little to do with normal shelf life.

A major cookie and cracker manufacturer (#780FIS) stated:

"The average moisture content of our products is about 3%. This increases slightly on prolonged storage. At this low moisture content microbial spoilage is rare. Loss of flavor, fading of color, and rancidification are the changes which eventually render our products

unsuitable for the consumer....At room conditions and with conventional packaging some of our more perishable products show a definite reduction in quality of appearance and flavor in three months, others have been examined after more than a year of storage without apparent reduction in quality. With improved packaging, shelf life has been greatly extended."

5. Snacks--Snacks may include anything eaten between the three basic daily meals. The discussion here is limited to snacks generally considered as such by the consumer market and include baked items in the pretzel class, and fried items such as potato chips, corn chips, corn puffs, onion rings, and a large assortment of fabricated products, as well as salted nuts.

Aesthetic standards by which these products are judged are in the order of preference of (1) flavor, (2) texture, and (3) color (may be critical).

Baked items such as pretzels and items of a similar nature are usually baked to a relatively low-moisture content, i.e., approximately 5 percent, and are judged by the consumer for their crispness. Loss of crispness is the main quality factor that downgrades these products. Normal storage does not result in any health hazard. Various types of sealed packages are used ranging from a glassine lined box with sealed paper overwrap to single and multiple layered film pouches and laminated bags.

Fried items, particularly such items as potato chips, are subject to deterioration, especially from rancidity. The packaging materials used are extremely important in providing durability. Packaging materials and such processes as nitrogen flushing are carefully chosen and balanced to eliminate the need for using packaging materials which could extensively increase shelf life but at significant additional cost.

Because these products are generally deep fat fried, they retain a sufficient amount of the frying oil on their surfaces which can eventually become rancid. Besides the obvious deterioration of odor and flavor which occur with development of rancidity, some rancid fat may develop toxicity (3). However, this would result in sufficient off odors to prevent the ingestion of the product by consumers (#505FIS). Toxicity is currently being investigated by several industrial and university groups in the United States.

Potato chips can be considered representative of other fried snacks. They are normally stored at prevailing temperatures. If they were stored at refrigerated temperatures, they would last at least twice as long as they currently do at room temperature.

Shelf life of fried snacks in general can be extended over various time periods by the type of packaging used. Simple cellophane transparent film pouches are least durable. There are various combinations of packaging materials, usually laminates consisting of such materials as aluminum foil, polyethylene waxed paper, polyvinylidene chloride, and others, including cans. Shelf life can be further extended by removing air and adding an inert gas such as nitrogen. In this way, the normal 1-month shelf life could be extended to 6 months.

As indicated above, refrigerated storage will also add to shelf life. As in other foods, the combination of materials and conditions for shelf life maintenance varies. Exposure of fried items to sunlight or artificial light will accelerate spoilage, as will storage in warm areas of 80°-90°F. temperature.

Company #25FIS, one of the leading producers of potato chips, uses a package and frying oil which are not conducive to very long shelf life. In addition, it depends on frequent deliveries and a weekly turnover, even though this product would probably be usable for a month provided it is not subjected to extraordinary conditions of temperature or light. This company codes all its packages to indicate date made, shift, and plant of manufacture.

Company #710FIS has set a shelf life of 2 weeks or less on its snacks, with automatic pickups. This company's products are coded either by date of manufacture or pickup date.

Company #65FIS packs synthetic snacks which imitate potato chips in cans in which they can be satisfactorily stored for 6 months.

Salted, roasted nuts are also fried in oil. However, a current trend has been to "dry roast" nuts, one of the objectives of this procedure being to produce salted nuts with less calories per unit weight than would result from the conventional oil roasting process. The storage life of the salted, roasted nuts, like that of potato chips, varies considerably depending on the type of container used for packing. Nuts packed in single film pouches will have a relatively short shelf life because of the detrimental effects of light and air, while those packed in cans under vacuum or under nitrogen have considerably longer shelf life.

FDA-permitted antioxidants may be used by some processors of potato chips and similar snacks and in salted nuts to retard rancidity and prolong shelf life. A manufacturer of snack foods (#710FIS) stated:

"The quality factors used in controlling acceptable shelf life are based on shelf life studies prior to new product introduction and upon experience in the market place.

"As you well know, the shelf life varies considerably with the different types of products. At one extreme would be the conventionally sterilized products such as evaporated milk. Here we have over eighty years experience in developing product and equating this with acceptable shelf life under a wide range of conditions. At the other extreme would be fresh refrigerated dairy products and snack foods. With snack foods, this is two weeks or less from date of manufacture.

"It is our practice to store new products under various conditions of temperature and humidity (many at extreme conditions) prior to writing final specifications and releasing of product for market distribution. I think this is standard practice among the major food firms."

6. Premixes--This product consists primarily of mixed dry ingredients for making a wide variety of baked products which require addition in home preparation of such ingredients as water or milk and eggs. The mixes are

sometimes supplemented by packages of icing concentrates or toppings. Shelf life varies from 6 to 18 months or more, and is mainly limited by gradual loss of leavening powers and sometimes by development of rancidity of the shortening. Storage, if it is not in a hot, humid area, involves no health hazard.

7. Flour--Under this heading are included flours made from wheat, rye, and corn, with wheat being the predominant one. Flours produced from other sources such as potato, rice, and buckwheat, although available in specific localities, are in considerably less demand. Various varieties of wheat are combined to produce bread flour, cake flour, and all purpose flour. Flour is the result of selecting varieties of hard and soft wheat which yield proteins in higher or lower percentages and of varying rheological qualities. In addition to wheat variety selections, the properties of flour can be modified by milling, aging, and chemical bleaching. Whole wheat kernel is milled for producing whole wheat flour. For other types of flour, the bran portion is removed. Milled flour is sifted to produce product varieties of specified fineness and uniformity. Flour may or may not be bleached, enriched with vitamins or unenriched. Bleaching and enrichment, as applied to flour, are governed by FDA regulations.

Self-rising flour contains leavening agents in definite ratio to flour to produce baked products according to specified recipes. Ready-mixed flours containing all the ingredients except water to make such products as biscuits are also on the market. These are similar to the premixes discussed above. Rye flour is processed similarly to wheat flour, but is virtually never used without a minimum ratio of wheat flour added because rye lacks the gluten necessary to produce dough firm enough to retain the gas produced by the carbon dioxide of the leavening agents. Mixtures of various flours, with or without leavening agents, are produced for making specialty items such as buckwheat pancakes.

From the time the grain itself is produced, constant sanitary practices must be observed to prevent access of insects to the grain and flour. Despite the best procedures followed by the principal flour millers, there is always the possibility of insects infesting flour products at some stage before the consumer uses it. Insect activity practically stops at temperatures below 45°F. But at retail store temperatures, this activity can take place should insect infestation have occurred. This occurrence, however, is infrequent and would not be controlled by any code dating.

Straight flours retain shelf life longer than those containing leavening agents, etc. Losses of quality are gradual and varied, and usually aesthetic in nature. Aging can produce slight yellowing or development of off flavors. Nutritional losses in the form of vitamin and mineral content reductions are not the result of storage, but occur during the milling operation.

A decrease of leavening power is likely to be the main quality loss of self-rising flour. Packages of flour are sealed tightly to keep out insects and to protect the contents from moisture from the atmosphere. Protection against moisture is especially important for self-rising products.

An industrial source (#350FIS) stated:

"Shelf life has been established on all consumer products. This depends on the stability of the product, packaging material used, and the end result. For example, we would expect family flour to stay in good condition up to one year, where cereals and snacks shipped in a humid climate may be expected to have a shelf-life of only 6 weeks."

8. Refrigerated doughs and semibaked goods--Refrigerated doughs deteriorate through loss of leavening power. They are normally quite stable if kept continually refrigerated and will usually keep for about 8 to 16 months or more, depending on formulation. In addition to this loss of gassing power, some rancidity and off-flavor can develop owing to fatty components. This development can be successfully retarded by means of legally permitted antioxidants.

Unlike refrigerated doughs, the shelf life of semibaked goods is not limited by loss of leavening power because these products have actually been baked but simply lack the final browning. They are relatively moist and so may be subjected to mold growth at either room temperature or under refrigeration; FDA-permitted mold inhibitors may be used to retard mold growth.

A producer of these items (#130FIS) stated:

"The product changes which determine the end of the shelf life are primarily due to the loss of carbon dioxide. This causes the dough to turn from an off-white to a distinct grayish color. Approaching container failure also enters into the determination of the effective shelf life."

Another source (#715FIS) stated:

"Loss of functionality is gradual. Shelf life is determined by baking performance. Refrigeration at 35°F. to 45°F. [is desirable]. A loss in baking performance [will occur] if minimum shelf-life requirements [are] not met."

In reply to the question, "What temperature conditions are suggested or designated for refrigerated dough products?" company #130FIS responded, "We recommend that during its shelf life, product should be stored from 38 to 40°F. We do not specify relative humidity conditions."

VII. PRESENT PRACTICES OF CODE DATING/PUBLIC DATING

A. Voluntary Food Industry Code Dating and Monitoring

1. Bread--Bread is usually coded by one of several methods, which are not intended for consumer knowledge but are primarily for stock rotation by sales or store personnel. One method is the use of a colored plastic clip for tying the end of the bread bag; the color is altered daily, with specific colors for each day of the week. Another method is the use of thin line printed stripes on the wrapper, starting with one stripe for the first day of the week. Some bakers use designations such as "Fresh Monday," printed on the wrapper or on stick-on labels.

A major retail chain (#440FIS) openly displays the following system of coding in its stores for breads:

<u>Bread delivered</u>	<u>Code/Letter</u>	<u>Days to be sold</u>
Monday	Red/A	Mon. and Tues.
Tuesday	White/B	Tues. and Wed.
Wednesday	Blue/C	Wed. and Thurs.
Thursday	Yellow/D	Thurs. and Fri.
Friday	Green/E	Fri. and Sat.
Saturday	Orange/F	Sat. and Sun. (in stores open on Sunday)

An industrial manufacturer (#165FIS) stated in reference to its bakery products including bread:

"Baked Products--picked up by personnel when the shelf life period terminates....Although we remove products from the retail stores at the time intervals indicated (2-4 days), these items are completely satisfactory for consumption and we mark them as follows:

THRIFT--All merchandise bearing this label is surplus, either having been returned unsold from stores, or deviating from our rigid quality standards because of defects in shape, size, or similar faults. Because of the fact that it may not be as fresh as our regular products on sale elsewhere, it is sold at reduced prices. We wish you to be aware of this so that your purchases will meet with your satisfaction.

"These are then sold in 'Thrift' stores at reduced prices and generally we are unable to supply all the customers who want this product."

2. Cakes--Cakes offer a considerable range of shelf life which is governed by the type of crumb texture, combination of ingredients, degree of perishability of icings and fillings, and the selection of combinations of these variables. Some even require continuous refrigeration. One large baking company (#165FIS) established shelf-life periods for much shorter periods than actually needed for the whole period of usability. Any overage products go to its thrift shop; if not sold there within a given time, they go into animal feed.

3. Pies--Pies generally have about a 1 to 3-day shelf life, whether fruit pies, which require no refrigeration, or highly perishable types like custard-filled, which require refrigeration. They are generally boxed to protect them from breakage and handling. Some of this type of packaging has sanitary but few other noticeably beneficial effects on the shelf life of the pies. (Fresh pies differ noticeably in method of presentation and packaging from frozen pies. The latter are discussed under frozen foods.)

4. Cookies and crackers--These products have a longer shelf life than cakes. One large producer (#860FIS) rates his cookies as having a shelf life of 30 to 90 days; his packages are all code-dated. Still another baker

(#500FIS) rates his cookies as salable for at least 6 months. Another industry source (#722FIS) stated:

"Every product we produce has a code stamped somewhere on each package as well as on every shipping case. The purpose of the code is two-fold. First, it enables us to identify the plant where a product was produced as well as date, shift, and production line. Secondly, it enables us to police our warehouse and retail shelf stocks to assure proper turnover and good housekeeping practices.

"Our own sales organization, as well as that of the Food Brokers representing us, is trained to read each product code. Our more perishable products have a shelf life, depending on section of the country and time of the year (and sometimes warehouse conditions), ranging from 4 months up to one year. The men check product codes on grocers' shelves and, where permitted, in distributors' warehouses and will remove and destroy those products with codes indicating the products are no longer fit for resale."

Another large manufacturer of crackers and cookies (#620FIS) has established his own sales personnel to supply all retail outlets with his products. This sales force also monitors stock on the merchants' shelves, so that their turnover is far more frequent than any established shelf-life expiration. Products not sold as rapidly as anticipated are sampled and tested by the company's laboratory; decisions are made on the lot in question and on possible future change of sales and manufacturing policy on the particular item.

This company exercises quality control of all of its raw materials, including food ingredients and packaging materials of products in process, and finished products from all bakeries. The company uses a coding system which is known to all salesmen and which indicates day, month, and year of baking, the shift, and the bakery location.

Another company (#680FIS) stated, "We do have a code system on our packages whereby we can keep a strict control on goods sold to the consumer."

5. Snacks--The nature of these products varies considerably in maintaining quality. Among those of the shorter shelf life are potato chips (see earlier section on snacks for rationale). For the purpose of economy, this item is made and packed so that it does not have as long a shelf life as would be the case if ideal methods and means were used. One of the major manufacturers (#25FIS) code dates each package with the date made, shift, and plant of manufacture. Although the potato chips remain stable for about 30 days, this processor arranges for weekly deliveries, thus allowing considerable time for sale of the product before expiration date.

Roasted nuts are packed in transparent bags and also in the familiar vacuum packed cans. One of the large supermarket chains (#30FIS) sets 10 weeks shelf life for regular roasted and 12 weeks for dry roasted nuts, but 1 year for nuts in cans.

6. Premixes--These are code dated by one of the large manufacturers (#360FIS), giving in cryptic form the month, year, and day of production as

well as the plant at which they were produced. This same manufacturer considers his products to have 1 to 2 months shorter shelf life in the southern half of the United States.

7. Flour--This product is normally packaged in paper sacks and cartons, both of which are sealed to prevent entrance of insects, moisture, and foreign odors. One major miller (#360FIS) code dates all of his products cryptically with month, year, date, and plant of manufacture.

8. Refrigerated doughs--These are perishable, mainly because of the slow loss of the leavening agent, carbon dioxide. Continued refrigeration at 35 to 45°F. is required. One principal manufacturer (#715FIS) of these products embosses the expiry date on the bottom metal end of each container. He states, informally, that 95 percent of his products are still good performers at the date of expiry and beyond those dates in many cases. Indicated on the package is the statement, "For best results use before date on the end of can."

B. Legal or Required Dating

1. Federal--There are no Federal requirements for public dating. The FDA regulations contained in the Federal Register, April 26, 1969, Good Manufacturing Practices, indicate that the FDA would like code dating for interstate and intrastate commerce shipments. FDA has standards of identity and specifications for mineral and vitamin levels of flours.

2. State and Municipal--Except for Arizona, there are no State and municipal dating requirements. The State of Arizona requires that bread be removed 3 days after shelf stocking (see Legal Report, appendix I).

3. Foreign--There are no distinct foreign requirements on bakery products (see Legal Report, appendix II).

C. How Dating Influences Quality Maintenance: Advantages and Disadvantages of Dating

As stated earlier, temperature, handling, and sanitary practices are more important than dating. If dating were to be applied, it would give a false sense of security in potentially hazardous areas. Coding is useful to the food industry to monitor and remove its overaged products. Expiry dating of refrigerated uncooked doughs prevents consumers from getting products which may have lost leavening power and would suffer from a functionality quality loss.

VIII. FOOD PRODUCT ITEM LIST

A. Shelf Life--Food Industry Sources (FIS)

<u>Food item</u>	<u>Time*</u>	<u>FIS No.</u>
Baked goods (frozen)	1Y	745
Bread, white	4-5D (Summer)	880

*Y = year; M = month; W = week; D = day.

<u>Food item</u>	<u>Time</u>	<u>FIS No.</u>
Bread, white	6-7D (Winter)	880
Bread, white	30+D (Frozen)	880
Bread, white	2D	25
Bread, whole wheat	2D	25
Bread, rye	2D	25
Bread	2-4D	165
Bread, white/bagged	2D	530
Bread, farm style	3D	530
Bread, whole wheat	3D	530
Bread, cottage rye	3D	530
Bread, snack rye	6D	530
Bread	2D	530
Cakes	4-7D	530
Cake, angel	14D	570
Cake, cream-filled	14D	570
Cake, chocolate	14D	570
Cake, cottage	14D	570
Cake, cup	14D	570
Cake, fruit	24M	630
Cake, fruited	14D	570
Cake, layer	14D	570
Cake, Madeira	14D	570
Cake, sponge	14-28D	570
Cake, strawberry-filled	14D	570
Cup cakes, cream-filled, in transparent films	5D	25
Cup cakes, cream-filled, in foil pouches	10D	25
Donuts	1-4D	530
Matzo	6-8M	420
Muffins	4-5D (Summer)	880
Muffins	6-7D (Winter)	880
Flour, all purpose	15M	360
Flour, cake	15M	360
Flour, self-rising	9M	360
Frosting mixes	8M	30
Frosting mixes, creamy	10M	360
Frosting mixes, fluffy	18M	360
Frosting, ready-to-spread	6-8M	360
Gingerbread mixes	18M	360
Mixes, muffin	10M	360
Mixes, pancake	10M	360
Mixes, biscuit	10M	360
Refrigerated dough	9-10W	130

IX. RECOMMENDATIONS ON BEST MEANS OF FOOD QUALITY MAINTENANCE

Open expiry dating is not recommended for any of these products except for refrigerated doughs. One of the principal manufacturers is currently doing this voluntarily, and the others presumably would find little difficulty in following this practice.

If the product has been abused by subjection to too high temperatures or has been exposed to unsanitary manufacturing conditions, expiry dating could give the consumer a false sense of security. Hence, common application of public expiry dating is not recommended.

Open dating of manufacture is recommended on all shipping cases and overwraps. Bread delivered in returnable trays should be excused from such a requirement.

To encourage proper stock rotation by the merchants and consumers, each individual package unit of products other than bread should be marked with date of shelf display. Bread should be color coded with a tie, tag, or label, to indicate date of shelf display. Such code meanings should be openly displayed and explained to consumers.

X. REFERENCES

- (1) Chain Store Age, 1969 Supermarket Sales Manual, Lebhar-Friedman, Inc., New York, N.Y., July 1969.
- (2) Crisley, F. D., et al., "Multiplication of Staphylococcus Aureus in Synthetic Cream Fillings and Pies," Public Health Reports, Vol. 79, No. 5, Public Health Service, U.S. Department of Health, Education, and Welfare, Washington, D.C., May 1964, pp. 369-376.
- (3) Krehl, W. A., and Barboriak, J. J., "Factors Affecting the Utilization of Food Nutrients by the Normal Organism," Ch. 13, in Nutritional Evaluation of Food Processing, by R. S. Harris and H. von Loesecke (eds.), John Wiley and Sons, Inc., New York, N.Y., 1960.

XI. REPORT REVIEW COMMENTS

FIS#45 stated:

"...several of our departments have reviewed this draft and the following represents a consensus of various opinions.

"Your recommendation regarding date of manufacture to be indicated on the outer cases to assist in stock rotation appears to be a useful one, however, open dating of the retail package itself is proving to be extremely wasteful in those countries in Europe where this experiment has been approved and steps are now being taken to change the open date coding with all types of qualifying clauses in order to prevent the wastes that are now incurred when newer merchandise is added to older stock on the shelf.

"The stamping of the date of a shelf display (DSD) by retail stores is in most of our opinions, more likely to be a disservice to the consumer than a service to him. Such dating could give the consumer a false sense of security that as of the date stamped on the container, the product was of the highest possible quality. When, in effect, much of the damage due to mishandling may have occurred after the product has left the manufacturer's plant and immediately before the date proposed by your team has been placed.

"We do not believe that it would help rotation more than DOM, but it would really incur wastes because no consumer would pick up an older date the moment a newer date is placed beside it on the shelf.

"We agree that certain food products with real time limits on their wholesomeness and performance (i.e., extended shelf life cookies, crackers, deep fat fried and snack foods.) should be dated with expiration codes but here again it is our experience that most manufacturers would make certain that products are removed long before such "legal expiration dates" are reached....

"We would like to take this opportunity to thank you for providing us with an opportunity of reviewing this draft, and we are hopeful that before broad regulation changes are made, very careful studies will be made on a limited scale to determine the possible economic effects that such coding recommendations might have."

FIS#620 stated:

"...However we do not agree with [recommendation] 'B', adoption of open date of manufacture etc. Unless there was universal adoption and consumer education it could create prejudices vs. a manufacturer with shelf stable products, i.e., refusing to purchase an excellent 3-month old product in favor of a two-week old product, inferior in quality at the time of manufacture.

"The above comment holds true for 'D', DSD for retail stores. Nor do we feel that there is a need for home stock rotation today. However, in sales to induce purchase in volume 'distress merchandise' should be so marked to preclude further abuse of product and consumer.

"In recommendation F, New Jersey should follow the codes established by Federal Agencies and other States. However, we see no need for limiting custard and cream filled pies etc. within 24 hours if refrigerated properly. Nor do we see any advantage and/or security in refrigerating 'other' pies, especially if acid type....

"The only additional comments on this report would be that New Jersey should adopt as many measures as possible guided by Federal levels so that uniformity among the States would prevail. We also feel that although municipal control of adopted codes is helpful, State agency control would be more effective and enduring...."

Chapter 3

MILK AND DAIRY PRODUCTS

INTRODUCTION

The major department of Milk and Dairy Products, which accounts for 8.20 percent of total supermarket sales (1), is divided into the following product groups:

- (A) Fluid milk, cheese, ice cream, butter, and dried milk (7.56 percent)
- (B) Refrigerated fruit juices (0.33 percent)
- (C) Dips (0.21 percent)
- (D) Simulated dairy products (0.11 percent).

Sections II, SUMMARY OF RECOMMENDATIONS; III, TYPE OF FOOD AND PRODUCT GROUPS; VII, PRESENT PRACTICES OF CODE DATING/PUBLIC DATING, B. Legal or Required Dating of product group (A) contain data for the other product groups. Section X, REFERENCES for (A), (B), (C), and (D), is included at the end of product group (D).

- (A) Fluid Milk, Cheese, Ice Cream, Butter, and Dried Milk

I. INTRODUCTORY REMARKS

Milk and dairy products have been aptly described as "nature's most nearly perfect food" (13). As a group, these products may be eaten at any meal, as snacks, and as a component of many hot beverages. Byproducts of milk have extremely wide applications, from plastics to foodstuffs ingredients. Milk is the subject of perhaps more food legislation and application of the dating concept than any other foodstuff in the United States as well as in foreign countries. Milk and milk products are widely recognized as potential health hazards and disease carriers unless carefully controlled by sanitary processing methods.

II. SUMMARY OF RECOMMENDATIONS (see also section IX)

A. General Recommendations

1. Adoption by the New Jersey Department of Health of the Coding Recommendations of the FDA Good Manufacturing Practices, Federal Register, April 26, 1969, for processed foods. Revelation of all such codes by manufacturers to the Department of Health on request by the latter. Adoption of these codes would require changing New Jersey Regulation No. 16p of "Regulations

Governing the Processing and Handling of Milk, Fluid Milk Products, and Milk Products" (May 25, 1964).

2. Adoption of the open date of manufacture labeling for all outer cases/overwraps, etc., to assist in stock rotation (with the exception of reusable milk cases or crates).

3. Voluntary coding of all individual containers in such cases/overwraps by the food industry with codes of its own choosing (similar in intent to item 1 above). Such codes might indicate plant location, date of manufacture of final product in container, shift, production line, and any other aspects of products at the manufacturer's discretion.

4. Stamping of date of shelf display by retail stores for stock rotation and as a consumer aid in home storage stock rotation.

B. Fluid Milk and Milk Products in Half and Half, Light Cream, and Heavy Cream

1. The open dating of milk cartons as now practiced in New Jersey should be abolished since it does not conform to the State's stated "requirements." In its place, a "requirement" should be established to control the temperature of pasteurized milk at a maximum of 45°F. in distributors' transportation equipment, and in retail outlets. This temperature should be reduced over a period of 5 years (i.e., by 1975) to 40°F., to allow transportation equipment and retail outlets sufficient time to replace present equipment which may not attain such temperatures.

2. Additionally, processors should code their products with the month and day of pasteurization, with the codes being made known to the New Jersey Department of Health. Such codes might be standardized to state the day and month in a numerical fashion, e.g., four-digit code: first two digits, month; second two, day; 0317 means March 17.

3. Implementation of date of shelf display by stamping at the retail outlet with day of week and month on individual cartons for stock rotation.

Anyone wishing to voluntarily introduce open dating should do so only with Department of Health approval. Implementation of these regulations should permit the introduction of improved fluid milk quality by processors who wish to update their processing technology to produce products with longer shelf life.

C. Ice Cream

Practices recommended are the same as for frozen foods, i.e., Three-Star System concept using in-store placards.

III. TYPE OF FOODS AND PRODUCT GROUPS

Dairy, by product group, category and variety

Product group	Percent- age of total sales	Product category	Percent- age of category sales	Percent- age of total sales	Product variety	Percent- age of depart- ment sales	Percent- age of total sales
Fluid milk and cream	3.50						
Cheese	1.69	Cheese	100.0	1.685			
					Sliced Wedges, links, etc.	33.5	.565
					Processed	19.5	.328
					Cottage cheese	14.8	.249
					Jars and dips	10.1	.170
					Grated	7.4	.124
					Cream cheese	4.0	.068
					Shredded and cubed	4.0	.068
					Imported	2.7	.045
					Italian	2.0	.034
					Cheese combos	1.3	.023
						.7	.011
						100.0	1.685
Ice cream	1.35	Ice cream, etc.	100.0	1.346			
					Vanilla	18.5	.249
					Combo flavor	18.5	.249
					Chocolate	8.4	.113
					Strawberry	4.2	.057
					All other flavors	14.3	.192
					Milk ice and special	27.6	.373
					Sherbert	3.4	.045
					Synthetic	3.4	.045
					Dietetic	1.7	.023
						100.0	1.346
Butter	.88						

Source: Chain Store Age, 1969 Supermarket Sales Manual (1), Lebhar-Friedman, Inc., New York, N.Y., 1969. Used with permission of publisher.

Product group	Percent- age of total sales	Product category	Percent- age of category sales	Percent- age of total sales	Product variety	Percent- age of depart- ment sales	Percent- age of total sales
Ref. fruit juices	.33						
Dips	.21						
Creamers (simul. dairy)	.11	<u>1</u> /Coffee creamers (powdered)	100.0	.109	3-8 oz. 9-13 oz. 14 oz. and over	38.0 46.0 <u>16.0</u> 100.0	.041 .051 <u>.017</u> .109
Dry milk	.14	<u>2</u> /Dry milk	100.0	.143	Large (8 qt. and over) Small (under 8 qt.) All other canned and dry milk	58.4 38.7 2.9 <u>100.0</u>	.084 .055 .004 <u>.143</u>

1/ From "Coffee" in (1).

2/ From "Canned/Dry Milk" in (1).

IV. TYPE OF PROCESSING AND PRESERVATION

The principle behind the preservation of milk and milk products is treatment to control natural microorganisms, pathogenic and harmless, usually by heating or adjustment of acidity (pH) levels to make the products safe for consumption. The following description of processing procedures is limited to the procedures affecting the microbial and aesthetic qualities of milk and milk products prior to their consumption.

Fluid Milk and Milk Products

Production of a safe supply of milk begins with the maintenance of healthy dairy cows, as required by "Laws Governing the Production, Handling, and Distribution of Milk, Cream, and Milk Products" of the New Jersey Department of Health (2). Sanitary requirements for milking and subsequent storage and transportation of milk are contained in requirements of the various States and the Federal Government (5), as is the case in New Jersey. Various municipalities into which milk is brought, such as New York City, also apply their legal requirements to the processing areas before milk shipments are permitted into the area.

Milking is now a machine operation. Immediately after extraction from the cow, milk should be cooled at 40°F. or below as quickly as possible. Farms using "bulk" milk systems transfer all raw milk into refrigerated storage tanks, from which it is pumped into insulated tank trucks which take it to a central processing pasteurizing plant. While the use of bulk milk systems is increasing, there are still farms which use the conventional 40-quart cans for temporary storage after cooling, in which the milk is transferred by truck tankers for shipment to the receiving station.

The materials of construction used for the farm equipment, hauling equipment, and processing equipment may be required to conform to standards specified by State and local laws and/or regulations. The health and cleanliness of the employees, the health and cleanliness of the cows being milked, and the cleaning and sanitation of all equipment may also be specified by local legal "requirements."

Depending on the detailed "requirements" governing a particular processing plant, samples of the milk are analyzed on a statistical sampling basis for bacteria counts and other factors to determine milk quality and cleanliness of conditions existing at both the farms and processing plants. In this way, the bacteriological quality of the milk and milk products distributed to the consumer is determined from a public health aspect.

All fluid milk, excluding a relatively small amount of "certified" raw milk (except for vat pasteurization), is pasteurized at 145°F for 30 minutes (5), and then quickly cooled at 40°F. or below.

Most fluid milk is homogenized immediately before or during pasteurization to disperse the fat globules evenly in the milk, and much is usually fortified with additional vitamin D. Both fortification and homogenization are required to meet specifications when used (2). Some milk is separated to yield skim milk as well as cream which is then adjusted to various required percentages of butterfat for the consumer market.

Fluid dairy products must be cooled to 40°F. or below and kept there until delivered to the consumer. Lower temperatures are more effective for good shelf life (see section VII, subsection C below). In processing operations, milk and milk products are usually stored at 40°F. or lower. Such temperatures, however, are not readily maintained in channels of distribution, retail display, or during consumer use.

One representative processor (#30FIS) reports that his plant storage refrigerators are kept at 34°F. Actual temperature conditions in stores to which deliveries are made were reported to be nearer 45-50°F. than 40°F.

Fluid Milk Products

The various flavored milks and dairy drinks are usually pasteurized after the permitted additional ingredients have been added. Cultured products, such as cultured buttermilk, cultured milk, and cultured sour cream, are prepared by inoculating the basic dairy product which has been pasteurized with a specific quantity of a nonpathogenic lactic acid bacteria culture, and allowing

the organisms to grow and react for a specified time at a specified temperature, during which a desired amount of souring occurs. The reaction is stopped and the product cooled prior to packaging, shipment, and sale. Yogurt is prepared by fermenting whole milk with added milk solids (usually nonfat dry milk). A special yogurt culture usually consists of equal parts of S. thermophilus and L. bulgaricus.

Butter

Butter is made from cream which is pasteurized, cooled to 50°F. or lower, and then churned. The operation is so controlled that the butter has at least 80 percent butterfat. Salt is added at the end of the churning process. For "sweet" butter, salt is omitted.

Butter is packed automatically as it is discharged from the churn, and then immediately stored under refrigeration. Suitable packaging materials are necessary to protect butter during storage for loss of weight owing to evaporation of moisture and absorption of foreign odors. For short-term storage, refrigerator temperatures of 32 to 40°F. are adequate; for long-term storage, temperatures of minus 10°F. are used.

Cheese and Cheese Products

The many types of cheese can be roughly divided into about 17 groups. Each of the individual types has its own method of manufacture and no two are processed exactly alike. According to USDA Agriculture Handbook No. 54 (3), the 17 types are represented by brick, Camembert, Cheddar, cottage, cream, Edam, Gouda, Limburger, Neufchatel, Parmesan, Provolone, Romano, Roquefort, sapsago, Swiss, Trappist, and whey cheeses.

In general, all cheese is made from milk curds which are produced by milk coagulation by an enzyme, such as rennin, or by an acid, such as lactic. A small number of cheeses are made from the whey solids after their removal from the curds. A starter culture of bacteria, or less frequently of mold, is added to the batch of ingredients and allowed to grow under specified temperature and humidity for a specified time, depending on variety of cheese being made.

The milk or skimmed milk used for most cheese is pasteurized. Those cheeses for which the milk is not pasteurized, and which are not processed to high enough temperature, are required by FDA Cheese Standards to be cured for no less than 60 days at not less than 35°F., during which time sufficient lactic acid is produced to make the cheese an unsuitable medium for the subsequent growth of pathogenic bacteria. Additionally, any pathogens that might be present should no longer be viable.

The distinctive flavor, body, and texture of the various cheeses are the result of--(1) the kind of milk used; (2) the method used to curdle the milk and cut, cook, and form the curd; (3) the type of bacteria or molds used in ripening; (4) the amount and kinds of salt or other seasonings added; and (5) the conditions of ripening such as temperature, humidity, and length of time (3).

The various methods of handling and processing (cooking) the curd help to determine the consistency and texture of the finished cheese, and are responsible, for the most part, for yielding cheeses in the following categories:

(1) Very hard (grating)

- a. Ripened by bacteria: asiago old, Parmesan, Romano, sap sago spalen.

(2) Hard

- a. Ripened by bacteria: cheddar, granular or stirred curd, and caciocavallo.
- b. Ripened by bacteria: Swiss, Emmentaler, and Gruyere.

(3) Semisoft

- a. Ripened principally by bacteria: brick and Muenster.
- b. Ripened by bacteria and surface microorganisms: Limburger, Port Salut, and Trappist.
- c. Ripened principally by blue mold in the interior: blue, Roquefort, Gorgonzola, Stilton, and Wensleydale.

(4) Soft

- a. Ripened: bel paese, Brie, Camembert, cooked, and Neufchatel (as made in France).
- b. Unripened: cottage, pot, bakers, cream, Neufchatel (as made in the United States), mysost, primost, and fresh ricotta.

Ripening or curing occurs during a storage period of weeks to months at various temperatures. Both time and temperatures are controlled to suit the type of cheese being made. During ripening, one or more significant changes take place, principally through the growth of certain bacteria. These usually cause the development of characteristic odors and flavors, as well as the development of lactic acid to prevent growth of pathogenic organisms. In some cheeses, such as the cheddar type, the texture changes noticeably during ripening from rubbery to a characteristic smooth or crumbly texture.

"Fresh" cheeses, like cottage cheese, are usually made from pasteurized skimmed milk by addition of a bacteria starter. It is not ripened or cured, and must be handled as a fresh dairy product. Another unripened cheese is cream cheese, usually made from cream, or a mixture of cream and milk. It has a lower moisture content, usually around 50 percent. Variations in manufacturing methods have a significant effect on shelf life.

Processed cheeses are made by a variety of methods and include those which are reworked in some way after curing. They may consist of some freshly made cheese to which fully ripened cheese is added. There is some method of

disintegration of the ripened cheese before mixing. The whole mixture is melted at a temperature high enough to be equivalent to pasteurization. This produces a processed cheese which has suitable flavor, texture, and color, and requires no further ripening. Various natural cheeses may also be blended this way, either to standardize them with different lots of the same type of cheese, or to mix two or more different varieties of cheese to produce a desired effect. Fruits, vegetables, and meats may be added to processed cheese, provided they are noted on the label.

Cheese foods are blends of different types of cheese and other dairy products, other ingredients, such as fruits, vegetables, meats, or spices and gums melted with the basic cheese. Cheese foods are usually softer in texture, and melt more quickly because they have additional dairy products as milk solids, nonfat milk or whey added and are higher in moisture content.

Cheese spreads usually have more moisture than cheese foods, and contain a stabilizer. They are spreadable at room temperature.

The USDA has established grades for some varieties of natural cheese. These grades are based on flavor, body, texture, finish, appearance, and color. Use of this grading service by manufacturers is optional. Cottage cheese may have a mark on its container stating that it is "quality approved" by the USDA.

Processed cheese and cheese foods are not Federally graded, but may be inspected and consequently bear an inspection stamp shield.

Most cheese should not be frozen because texture and consistency are damaged by low temperatures. Storage conditions most suitable for cheese vary considerably. Table 1 gives a general view of the storage requirements of cheese.

Table 1.--Storage of common types of cheese, by ideal and maximum temperatures

Type of cheese	Temperature, °F.	
	Ideal <u>1/</u>	Maximum
Brick	30-34	50
Camembert	30-34	50
Cheddar	30-34	60
Cottage	32-34	45
Cream	32-34	45
Limburger	30-34	50
Neufchatel	32-34	45
Process American	40-45	75
Process brick	40-45	75
Process Limburger	40-45	75
Process Swiss	40-45	75
Roquefort	30-34	50
Swiss	30-34	60
Cheese foods	40-45	55

1/ For longest shelf life. Source: ASHRAE Guide and Data Book, Applications for 1966 and 1967 (7), used with permission of the American Society of Heating, Refrigerating, and Air-Conditioning Engineers.

Ice Cream and Frozen Dessert Products

Frozen desserts include ice cream, sherbets, frozen custards, water ices, and special dietary items. The composition of ingredients varies considerably but the whole mix is basically pasteurized, at a higher temperature than that for milk, homogenized, quickly cooled to about 45°F. or lower, and stored until frozen (4). Various flavors, colors, fruits, and nuts may be added to the mix after pasteurizing and before or after freezing, which preserves palatability. Introducing these unpasteurized items may decrease quality unless the fruits and nuts are handled sanitarily. At freezing, hardening, and storage temperatures, food poisoning and psychrophilic organisms do not grow (see fig. 4 under Fruit Juices (B) below).

Freezing is done at 20 to 22°F., either by batch or by continuous process, during which time air is incorporated. The product is immediately packed into containers, or into molds for novelty items. The packaged product is then "hardened" at -20 to -50°F. After hardening is completed, ice cream may be stored at low temperatures for long periods of time, a typical posthardening storage temperature being -10°F.

Design and sanitary maintenance of ice cream processing equipment are normally governed by State and Federal regulations similar to those covering milk processing.

Dry Milk

Both whole milk and skimmed milk are dehydrated by spray or drum drying. Most drying is of skimmed milk to produce nonfat dry milk solids. This product, when properly packaged and sealed, is stored and sold at normal room temperatures. Dried whole milk, being more perishable because of its butterfat content, usually is refrigerated during storage.

V. QUALITY CHARACTERISTICS and VI. PROCESSING AND STORAGE QUALITY LOSS FACTORS

Fluid Milk and Milk Products

Few foods exceed milk as a single source of dietary requirements needed for maintenance of proper health, especially for children and older people.

In addition to nutritional factors, the quality of fluid milk and milk products depends on flavor, odor, and microbiological content. This is particularly true of fluid milk, cream, and flavored milk drinks.

There are some small unavoidable losses of vitamins and flavor during pasteurizing and storage of fluid milk. These can be very significant if milk is stored in direct sunlight in clear glass bottles for even a few hours, or near certain types of artificial illumination. Development of undesirable flavor (sunlight flavor) can also result from these types of exposure to light.

Growth of lactic and other bacteria and product souring is usually responsible for the end of shelf life of fluid milk, cream, skimmed milk, and flavored milk drinks. Milk is a perfect medium for the growth of bacteria; in fact, man competes with microorganisms for the same nutrients. Milk has always had the potential to serve as a disease carrier. In recent years, however, milkborne illness outbreaks in the United States have been greatly reduced owing to increased application of sanitary measures at all stages of production and consumption. In 1968, milk and fluid milk products were responsible for only 2.6 percent of the total reported outbreaks of illness; in 1938, the figure was 25 percent (5). The use of sanitary practices in all stages of production and the maintenance of low temperatures are the primary controlling factors in quality and shelf life of fluid milk.

Butter

The principal quality characteristic of butter is its relatively pleasant flavor. The main indication of butter deterioration is the development of undesirable flavors which may be caused by: (1) fat oxidation, (2) growth of microorganisms, (3) activity of enzymes, (4) absorption of odors from the atmosphere, (5) catalytic action by metallic salts, and (6) low pH of salted butter.

Butter is not likely to be a health hazard owing to storage because at conventional refrigeration storage temperatures, pathogenic organisms do not grow in butter. In addition, most harmful organisms that might have been present are killed during pasteurization of the cream from which the butter is made.

According to ASHRAE Guide and Data Book (7), butter may be satisfactorily stored for 1 year at 0 to -10°F. and 80 to 85 percent relative humidity, or for 2 months at 32 to 40°F. and 80 to 85 percent relative humidity. Much butter is stored during high milk production seasons to be used later, i.e., much of the butter sold during the winter has been made during the previous spring.

Butter may be optionally graded by the USDA and given a score, such as 93 or a grade of AA. This can be done at the time of processing, but since there is no requirement to rescore this product when it is packaged or distributed, possible changes in storage are not reflected in the score.

Dating of the butter would not be meaningful because a packaging or distributing date would not reflect changes caused from improper handling or storage. Different storage conditions could readily account for different qualities at the time of sale of two lots of butter of equal age, stored under dissimilar conditions.

Cheese

Flavor and consistency are the principal quality factors that consumers require in cheese. Many of the ripened cheeses, such as Swiss, get their characteristic flavor and texture only during the storage required for ripening. The fresh cheeses, especially of the cottage type, may develop off-flavors and

odors. One major quality change results when "wheying off" occurs. Many cheeses, if stored over 68°F. will be subject to oiling off. Processing and storage conditions frequently minimize this danger.

Nutritional losses differ widely in all the various cheeses, and suggest the need for a comprehensive study in this area. All cheeses, however, are considered excellent sources of protein. Loss of other nutrients, including minerals and vitamins, varies widely among cheeses owing to manufacturing methods. While many of these losses occur during processing, some also take place during aging. However, some vitaminic values may increase during storage as a result of continued bacterial action.

Storage life of cheese varies widely, depending on the type of cheese and the nature of the process of manufacture as well as the degree of sanitation used by the manufacturer. Cottage cheese normally has a shelf life of 2 weeks, although one reputable processor assigns 60 days to his cottage cheese. Two major processors use 90 days as the shelf life for cream cheese. Some other cheeses, such as Parmesan and Romano, are given as long as a 7-month shelf life by one processor.

Ice Cream and Frozen Desserts

Texture and flavor are two major quality factors expected of frozen desserts, and of ice cream in particular. The capability of ice cream texture to withstand temperature changes is improved by the incorporation of stabilizers, including gelatin, locust bean gum, pectin, gum guar, seaweed gums, carboxymethylcellulose, and others. They serve to improve and maintain body and texture, and produce a smoother product which does not melt as rapidly on serving.

There is no danger of health hazard owing to storage of ice cream because no pathogenic organisms grow at frozen storage temperatures. (See fig. 4 in the section on Fruit Juices.) The main factor of deterioration is in loss of textural quality caused from temperature cycling, which has a gradual tendency to develop grainy ice crystals and a consequent loss of smoothness. A much less frequent quality loss is mild flavor deterioration, or absorption of foreign flavors.

Temperature control is important to maintaining quality. Ice cream that is kept in the hardening room from its original time of freezing can be kept in good quality for at least 6 months, and probably as long as 1 year. But fluctuating temperatures after it leaves the processing plant shorten its shelf life. Therefore, one major manufacturer (#760FIS) and one food chain (#30FIS) having ice cream made for private sale code date ice cream with an expiration date of 90 days after processing.

To guarantee top quality ice cream for any given time requires maintenance of -10°F. as ideal, but never above 0°F. Although these conditions are sometimes met, a look at most store cabinets suggests that this is not always the case. An industry source (#580FIS) stated,

"In the case of normal products under average storage conditions, we expect the shelf life to be approximately twelve weeks. There are exceptions to this statement of course and in particular a chocolate coated ice cream will last considerably longer, whereas some deluxe type products would have a life of less than six weeks."

Another producer (#760FIS) stated:

"...You indicate that we have conducted a comprehensive study on the storage, distribution and display of ice cream in supermarkets. This is not quite true, in the sense that our observations are of a routine nature, as part of a broad Quality Control Program which we have extended for the first time to the supermarket display case. We are routinely making observations on large accounts to which, because of their size in terms of volume, we are able to provide service. In these accounts, we are checking product temperatures, appearance of packages, cleanliness of cabinets, neatness of display, age of product, and cabinet temperatures. The information we accumulate is used by our Sales and Merchandising people, as they work directly with store management. We do not prepare any summary reports, other than the form that is used at the time the store survey is conducted. Therefore, I cannot give you anything in the way of a report.

"...We have established a coded shelf life [for]...ice cream of 90 days. Temperature requirements are as follows:

- a. Hardening room temperature: -15°F .
- b. Holding room temperature
(distribution branches): -10°F . minimum
- c. Truck temperatures: -10°F . ideal, never over 0°F .
- d. Store cabinet temperatures: -10°F . ideal, never over 0°F ."

Dry Milk and Dry Milk Products

Dry whole milk is not generally found in the retail market in quantities as great as that of nonfat dry milk (NFDM). It is usually restricted to baby formulas, and is therefore more likely to be found in drug stores. It is subject to oxidative changes of the fat, and is best stored under refrigeration. The USDA's vacuum-foamed dried whole milk packed in nitrogen is said to have a shelf life up to 1 year when refrigerated, but only 3 months when stored at room temperature.

Nonfat dry (skimmed) milk or NFDM is the product commonly found on the retail market shelves. Most of the NFDM on the consumer market has been "instantized," to make it easily soluble in water without lumping. NFDM has high nutritional value, containing practically all of the protein present in the fluid milk. There are partial losses of some vitamins during drying, such as thiamine and ascorbic acid. Vitamins A and D contents are lower in the dehydrated product on an equivalent basis with the original fluid milk; the loss is due to the cream removal operations and not to dehydration (vitamins A and D are fat soluble) (8). There is some loss in availability of protein as a result of dehydration, but the total protein remains about the same, on an

equivalent basis. Despite these nominal nutritional losses, the food value of NFDM is still so high that it is used as a "protein" ingredient in many manufactured food products. NFDM is used for its food and functional qualities in substantial quantities in many bakery products, frozen desserts, toppings, confections, candy, and many other foods.

Packaging materials and closures for containers must be of the moisture barrier type. Product durability is mainly limited by the development of stale flavor. This deterioration will normally not occur before 6 months. One large manufacturer has determined that his product will retain satisfactory flavor for 2 years at 70°F.

There is no health hazard resulting from the storage of NFDM. The publicity given to the finding of salmonella by the FDA in a leading product a few years ago showed that the outbreak was caused by contamination present in the contents of the package prior to closure rather than by storage. Assuming that salmonella are in raw milk before processing, the temperatures regularly encountered during pasteurizing and processing would kill all salmonella organisms. Hence, the presence of even traces of salmonella in packaged NFDM indicates that it was introduced at some stage between spray or roller drying, and final sealing of the package closure. There is no chance of any accidentally introduced salmonella bacteria multiplying within the package under usual storage conditions because of the low moisture availability in the product.

The only dating that would be of any value would be to practice the DSD recommendations made elsewhere in this report which would require the retailer to date packages at time of pricing and sales display, which essentially assures retail store stock rotation and permits the housewife to rotate her stocks at home.

An industrial producer (#15FIS) stated:

"...the shelf-life expectancy for nonfat dry milk should exceed 9-12 months. Nonfat dry milk, containing a moisture level of not over 4.0%, if properly packaged and stored, may be held for at least this length of time without undesirable effects to the product, i.e., physical and/or chemical changes, loss of nutrients, etc."

A manufacturer (#170FIS) of nonfat dry milk and "instant breakfast" type products, which contain dry milk as a main constituent and source of dietary requirements, reported the following in relation to his products:

- "1) In practically all instances, the shelf life minimum of one year is based on flavor deterioration; functionality other than flavor is generally considerably longer. For example, instant nonfat dry milk loses little of its nutritive quality or other functional properties after several years storage. We do, however, feel that two years is the maximum length of time the product should be considered acceptable from a flavor standpoint.
- 2) We use 72° as our standard temperature for one year minimum shelf life. This is required for all non-perishable products.

Actually, Tappil/ conditions are used for our storage studies, however, in most containers humidity is not a factor because we control moisture gain in products where this is critical by using the proper moisture barrier. Practically all of our products are acceptable based on the 9 point hedonic scale after two years storage. In [breakfast] products...the indicated vitamin potencies are based on two year storage studies.

- 3) Our vitamin fortification is based on the MDR's "Food & Drug Standards" rather than RDA's, which I am sure you know is the National Research Council Standards. Our values are based on current MDR standards."

VII. PRESENT PRACTICES OF CODE DATING/PUBLIC DATING

A. Voluntary Food Industry Code Dating and Monitoring

A national distributor of dairy products (#760FIS) wrote that his company code dates all its products and that,

"It is pertinent to point out, here, that our policy for shelf life is coded shelf life plus four days, that is to say that in our in-plant control procedures, we subject the above products to shelf life studies at 45°F. and expect that the products will remain salable at that temperature for the coded shelf life plus an additional four days."

"Shelf life storage requirements for other products are as follows:

- "(a) Cottage cheese--15 days
Product temperatures: Ideal 40°F. maximum, never over 45°F.
Coded with day, month, and vat number
- "(b) Sour cream--28 days: Same temperature requirements as for cottage cheese; coded with day and month (numerical)
- "(c) Fluid milk products--5 days: Same temperature requirements [as for cottage cheese]; coded with date of month (numerical)
- "(d) 'Ades and flavored drinks--12 days; Same temperature requirements [as for cottage cheese]
- "(e) Ice cream: Coded with day, month, and year (numerical-alphabetic)"

B. Legal or Required Dating

1. Federal--There are no Federal requirements for public dating of milk or milk products or for other product groups in this section. The FDA

1/ TAPPI--Technical Association of the Paper Pulp Industries. TAPPI room conditions are 73°F. and 50 percent relative humidity.

regulations contained in the Federal Register, April 26, 1969, Good Manufacturing Practices, indicate that FDA would like code dating for interstate and intrastate commerce shipments.

2. State--New Jersey is the only State that requires public dating of containers of pasteurized milk and cream (15). The New Jersey dating requirement is stated in N.J.S.A. 24:10 - 57.23 (2). California, Mississippi, Missouri, Montana, Oklahoma, and Virginia have coding requirements on various milk and dairy products (see Legal Report, appendix I).

3. Municipalities and Counties--Listed in order of population are those municipalities and counties which required dating in September 1969:

New York, N.Y.

Baltimore, Md.

St. Louis, Mo.

Jefferson County, Ala. (includes Birmingham)

Suburban Philadelphia, Pa. (eight boroughs and/or townships) (15).

With the exception of New York City, none of these "requirements" are listed in the Legal Report, because the various city authorities either were not contacted or refused to respond to the survey team's inquiries. These requirements are discussed in the Milk Industry Foundation's publication (15).

4. Foreign--Canada and other countries are assumed to have various coding or dating requirements (see Legal Report, appendix II).

C. How Dating or Coding Influences Quality Maintenance: Advantages and Disadvantages of Dating

Dating of fluid milk does not assure quality to the consumer, since the product from a plant operating at borderline sanitary standards with a recent date may be of inferior quality to milk several days older from a plant of higher sanitary standards. This can also lead to customer rejection of perfectly good milk of 1 or more days earlier date in favor of the latest date, and possibly result in ultimate loss and destruction of the older product of better quality.

A 1958 study by Dahlberg (6), which was largely concerned with open dating, recommended that "code marking of milk containers be practiced and a time limit from pasteurization to sale be established in the New York Sanitary Code to replace the dating requirement." Prior to 1958, dating was practiced but no time limits were established. It should be understood very clearly that deterioration of quality in milk and milk products is time-temperature dependent. Such was the basis for a 1959 study in Illinois (16), which had a dating requirement at that time. One result of the study, it is believed, was that dating was later abolished in that State. The study showed that "Chicago milk is of high bacteriological quality and that it can be stored for at least five days at 40°F. to 50°F. without serious bacterial deterioration taking place. Storage of milk at a temperature of 55°F. was found unsatisfactory for good keeping quality."

In a recently published 1969 nationwide study of quality and economic considerations in the dating of milk, the Milk Industry Foundation's Committee

for Study of Milk Availability (15) reported the following summary and conclusions (used with permission of the Milk Industry Foundation):

"Nature and Extent of Milk Dating

1. The practice of dating of milk has never been widely adopted. In recent years, the number of markets requiring the dating of milk has declined sharply. In 1957, dating of milk was required in 21 marketing areas. By 1969, only six marketing areas required that milk be dated.
2. Less than 10 percent of the U.S. population resides in markets where milk dating is required.
3. Since 1957, no additional marketing area has adopted dating regulations.
4. Adoption of the U.S. Public Health Service Grade "A" Pasteurized Milk Ordinance by the individual states has been the primary reason for repeal of milk dating legislation.
5. Processor coding of milk is widely used as a means of determining the age of milk offered for sale in stores."

"Influence of Milk Dating on Quality of Milk: A Review of Literature

6. Research does not support the premise that there is a meaningful relationship between age of pasteurized milk and quality.
7. A dating regulation which includes an expiration date may discriminate against the product by implying a deterioration of quality which actually is not occurring.
8. The age of milk offered for sale by stores is not significantly different between dating and non-dating markets.
9. Some method of inventory control through coding is necessary to insure proper rotation of milk in the store.
10. Dating regulations do not necessarily assure rapid movement of milk through marketing channels.
11. Properly pasteurized milk, free from post-pasteurization contamination, may be expected to show no increase in bacterial levels for at least 20 days if the temperature is maintained at 40°F. or below.
12. Psychrophilic and coliform organisms at the concentrations normally found in raw milk are destroyed by prescribed pasteurization procedures."

"Effect of Milk Dating on Practices and
Costs of Delivering Milk to Stores

13. Stores located in the six markets in which dating of milk is required generally receive more frequent delivery than stores located in contiguous markets in which dating is not required.
14. Volume of unsold milk returned by stores is higher in most dating markets than in markets where dating is not practiced.
15. Elimination of milk dating could lead to more efficient and less costly systems of delivery to stores. Potential savings from elimination of milk dating range from .8 of a cent to 1.4 cents per quart."

"Effect of Milk Dating on Availability of Milk in Stores

16. In each of the three paired sets of markets studied, store availability of milk was less in the dating market than in the non-dating market. In one paired set of markets (New York City vs. Chicago), the difference was highly significant; in the other two sets of markets, the differences were not statistically significant.
17. The incidence of special deliveries was higher in the dating market than in the non-dating market in two of the paired sets of markets (New York City vs. Chicago, Birmingham vs. Montgomery) studied; in the other set of markets, special deliveries were so few as to be of no consequence in either the dating or the non-dating market.
18. Milk inventories were lower in the dating market than in the non-dating market in two of the paired sets of markets (New York City vs. Chicago, Birmingham vs. Montgomery) studied; in the other set of markets, milk inventories were identical in the dating and non-dating markets."

Conclusions

"The practice of milk dating cannot be justified from public health, quality, or economic considerations.

"With respect to quality, research findings have demonstrated conclusively that age of milk is not a reliable index of quality. Furthermore, studies have indicated that the age of milk offered for sale in stores does not differ significantly between dating and non-dating markets. Thus, processor coding is as effective as milk dating as a method of inventory control to assure proper rotation of milk in stores.

"Neither does milk dating serve the economic interests of consumers. Dating deters the adoption of more efficient delivery practices and thus directly increases industry costs of delivering milk to stores. In the long run, these increased costs are borne by consumers.

"The Committee concludes that improvements in distribution practices, including in-store handling practices, would accomplish much more than milk dating in assuring consumers high quality fluid milk products."

The survey team tends to agree with these findings. Regarding point 4, the Milk Ordinance (5) does not require or mention any need for any form of dating or coding. Hence, it is likely that any States or municipalities adopting the ordinance automatically dropped the previous coding or dating needs unless they were especially retained under other local requirements. Supporting data for point 15 are presented in table 2.

Another part of the report (15) related to table 2 stated:

"Savings in milk processing and delivery costs resulting from elimination of milk dating would accrue principally from savings in delivery costs. As indicated above, more than 60 percent of the possible cost saving that would result from elimination of milk dating in New Jersey would stem from introduction of less frequent delivery systems to stores purchasing small quantities of milk per delivery."

The report notably does not say who would benefit from such savings--the consumer, industry, or both. The report makes special reference to New Jersey and its milk-dating requirement, stating:

"Containers shall be marked with the day of the week on which milk was pasteurized or with the term 'pasteurized' during the 24-hour period ending 6:00 a.m. (day of week at end of this period). There is no legal restriction on the time between pasteurization and sale."

A part of the report concerned the inspection in stores of the application of dating requirements or coding of milk containers. In reference to New Jersey, the report stated the following:

"Package Marking in Camden and Philadelphia

"In conjunction with the store handling practices survey, package marking surveys were conducted in both the dating and non-dating markets. Under the New Jersey dating statute, packages must bear the legend 'pasteurized during the 24-hour period ending 6:00 a.m. (followed by the day of the week at the end of this period.' Predating is permitted but the product cannot be offered for sale prior to 12:01 a.m. of the day of the week appearing on the package.

"Ninety-nine packages were selected at random by store enumerators in the 31 dating market stores and examined to ascertain the package marking. Only 82 of the 99 packages (82.8 percent) examined were marked in conformance with the existing dating statute. The remaining 17 packages (17.2 percent) did not conform to the package marking requirements of the dating market; in addition, seven of the conforming packages were marked with tomorrow's date and offered for sale before 12:01 a.m. tomorrow. Thus a total of 24 of the packages (24.2 percent) examined were in violation of the dating statute.

Table 2.--Estimated annual industry savings from elimination of milk dating, by markets, 1969

Market	Volume of fluid milk products sold through stores 1/	Potential cost savings from elimination of dating	Total possible industry savings per year
	<u>Million quarts</u>	<u>Cents per quart</u>	<u>1,000 dollars</u>
New York, N.Y.	950.0	1.2-1.4	11,400-13,300
State of New Jersey	515.7	1.0-1.4	5,157- 7,220
Baltimore, Md.	58.6	0.8-1.0	469- 586
St. Louis, Mo.	65.3	0.8-1.0	522- 653
Jefferson County (including Birmingham), Ala.	32.0	0.8-1.0	256- 320
Suburban Philadelphia, Pa.	9.1	1.0-1.2	91- 109

1/ Estimates of quantity of fluid milk products sold through stores were calculated from data compiled by (1) Dairy Division of the USDA; (2) Metropolitan Dairy Institute, Inc., New York, N.Y.; (3) New Jersey Milk Industry Association, Inc.; (4) Division of Dairy Industry, New Jersey Department of Agriculture; (5) Department of Agricultural Economics, Auburn University, Auburn, Ala.; (6) Alabama Milk Control Board, Montgomery, Ala.; and (7) Pennsylvania Milk Marketing Board.

Source: (15). Used with permission of the Milk Industry Foundation.

"Ninety packages were selected at random by store enumerators in the 30 non-dating market stores and examined to ascertain the package marking. Eighty-seven of the 90 packages (96.7 percent) were marked with a coded marking and three packages (3.3 percent) were unmarked. All unmarked containers were packaged by the same processor."

Other report findings support the view that dating is not as important as handling practices and temperature maintenance. The report demonstrates that shelf life depends on the type of processing and temperature of storage. In reference to temperatures, the study (15) reported 2/:

"The most recent data (1969) on the temperature of milk available for purchase by consumers is that of Barnard (11). A summary of approximately two years' data (588 samples) on milk available in the sales cases of Pennsylvania stores revealed that 34.9 percent of all milk was stored at 40°F. or lower, 46.6 percent was stored between 41 and 45°F and 18.5 percent was stored at temperatures in excess of 45°F. Barnard's data also indicate that the temperature of milk available for sale in stores fluctuates seasonally. Bi-monthly temperature data for July-August 1968 showed 28.3 percent of the sample temperatures in excess of 45°F., as compared to 7.8 percent of sample temperatures in excess of 45°F. during the most recent bi-monthly (Jan.-Feb. 1969) period."

"Witter, et al. (12) presented significant data on the temperature of milk available for purchase in stores in Chicago. Temperature observations were made on milk available for purchase during the summer and winter of 1957. A total of 60 temperature observations were made, 30 during April-July of 1957 and 30 during November 1957-February 1958. Although the observations were limited in number, the results parallel those reported by Barnard. Of the 60 samples, 35.0 percent of all milk was stored at below 40°F., 48.3 percent was stored between 40°-45°F., and 16.7 percent was stored at temperatures in excess of 45°F."

In reference to shelf life, type of processing, and storage temperatures, the report stated:

"Evans et al. (16) indicated that milk heated to temperatures in the range of 220° to 260° for 0.6 second had acceptable bacterial quality after four weeks of storage at 40°F. Use of temperatures between 240°F. and 260°F. for 0.6 second provided an additional acceptable bacterial shelf life (at 40°F.) of four weeks, a total of eight weeks."

"More recently, Finley and Warren (17) found that UHT (Ultra High Temperature) processing of milk (200° to 220°F. for 0.5 to 16 seconds) imparted an acceptable shelf life as long as 20 weeks when kept at 32°F."

"Grosskoph and Harper (19) in a recent study (1969) found that fluid pasteurized milk aseptically packaged in standard plastic coated paper containers and stored at 38.2°F. had a shelf life of four weeks."

2/ The sources cited in the following quoted material are shown verbatim at the end of the material.

Subsequent loss of quality was attributed to the growth of a psychrophilic spore-forming organism. It would appear reasonable to assume that higher storage temperatures would have encouraged more rapid growth of this organism. Their initial results suggest about 25 percent of raw producers' milk supplies contain psychrophilic spore-formers that were capable of surviving even UHT pasteurization."

"Many studies (Atherton et al. (21), Blankenagel et al. (22), Ford et al. (23), Huskey et al. (24), Smith (25), Elliker (26), and Witter et al. (27)) have shown that as the storage temperature of pasteurized milk increases the bacterial populations also increase, indicating that pasteurized milk should be held at 40°F. or below to achieve maximum shelf life."

"Studies by Langlois et al. (28), (29) and by Randolph et al. (30) have indicated significant differences among plants with respect to keeping quality of their milk, suggesting that plant sanitation procedures, storage temperatures, and time of holding were important."

¹¹Barnard, S. E., A Summary of Bi-Monthly Pasteurized Milk Quality and Flavor Surveys, unpublished data provided to participating Pennsylvania milk dealers. The Pennsylvania State University Agricultural Extension Service, April 1967 to February 1969.

¹²Witter, L. D., "Psychrophilic Bacteria--A Review," Journal of Dairy Science, Vol. 44, No. 6, June 1961.

¹⁶Evans, D. A., Lachman, E. L., and Litsky, Warren, "Some Observations on the Bacteriological Keeping Quality of Milk Processed by High Temperatures with a 0.6 Second Holding Time," Journal of Milk and Food Technology, Vol. 26, No. 10, October 1963.

¹⁷Finley, L. D., and Warren, H. B., "Storage Stability of Commercial Milk," Journal of Milk and Food Technology, Vol. 31, No. 12, December 1968.

¹⁹Grosskoph, J. C., and Harper, W. J., "Role of Psychrophilic Spore-formers in Long Life Milk," Abstract of Paper M87 presented at the 64th Annual Meeting of the American Dairy Science Assoc., Journal of Dairy Science, Vol. 52, No. 6, 1969.

²¹Atherton, H. V., Doan, F. I., and Watrous, Jr., G. H., Changes in Bacterial Population and Characteristics of Bottled Market Milk During Refrigerated Holding, The Pennsylvania State University Agricultural Experiment Station Bulletin 575, March 1954.

²²Blankenagel, G., and Humbert, E. S., "Observations on Keeping Quality of Low Bacterial Count Milk," Canadian Dairy and Ice Cream Journal, May 1965.

²³Ford, H. F. and Babel, F. J., "Milk Quality Problems Associated with Present Day Marketing," Journal of Milk and Food Technology, Vol. 22, No. 5, May 1959.

²⁴Huskey, J. E., Edmondson, J. E., and Smith, K. L., "The Effect of Temperature on the Keeping Qualities of Milk in Market Channels," Abstract of Paper M20 presented at the 55th Annual Meeting of the American Dairy Science Association, Journal of Dairy Science, Vol. 43, No. 6, June 1960.

²⁵Smith, A. C., "The Effect of Filling Temperatures of Milk on the Keeping Quality of the Product," Journal of Milk and Food Technology, Vol. 31, No. 10, October 1968.

²⁶Elliker, P. R., "Shelf Life of Food Products," American Dairy Review, Vol. 30, No. 9, September 1968.

²⁷Witter, L. D., Tracy, P. H., and Wilson, H. K., The Keeping Quality of Pasteurized Grade A Milk Offered for Sale in the Chicago Market, University of Illinois Agricultural Experiment Station Bulletin 646, June 1959.

²⁸Langlois, B. E., Randolph, H. E., and Crume, N. M., "Keeping Quality of Dairy Products Obtained at Retail Outlets, I, Low-Fat Milk, Skimmilk and Chocolate Flavored Milk," Journal of Milk and Food Technology, Vol. 29, No. 7, July 1966.

²⁹Langlois, B. E., and Rudnick, A. W., "Keeping Quality of Dairy Products Obtained at Retail Outlets, II, Whipping Cream and Half & Half," Journal of Milk and Food Technology, Vol. 31, No. 9, September 1968.

³⁰Randolph, H. E., Freeman, T. R., and Peterson, R. W., "Keeping Quality of Market Milk Obtained at Retail Outlets and at Processing Plants," Journal of Milk and Food Technology, Vol. 28, No. 3, March 1965.

On the basis of the above factors, the survey team recommends that fluid milk dating as now conceived of in New Jersey should be abolished since it does not conform to stated "requirements." In its place, a "requirement" should be established to control the temperature of pasteurized milk to a maximum of 45°F. in storage after pasteurization, in distributors' transportation equipment, and in retail outlets. This temperature would be reduced over a period of 5 years to 38°F. to allow transportation equipment and retail outlets sufficient time to replace present equipment which may not attain such temperatures. This could be accomplished by altering the New Jersey regulation of May 25, 1964 governing the processing and handling of milk, fluid milk products, and milk products. The reduction in temperature would have the effect of increasing the shelf life of milk and assuring quality to a greater extent. However, this raises the question of the actual shelf life of milk, and whether regulations should be established on a time-temperature basis for the length of time milk products remain on public sale.

There are two viewpoints on this matter. The first is that milk producers should be allowed to withdraw old milk on a regular monitoring and product

removal basis since only they are aware of shelf life and the factors controlling it. Such systems need the approval of the New Jersey Department of Health.

The second is that the Department of Health alone, or in cooperation with the milk producers, should conduct a study to develop time-temperature specifications on microbiological and aesthetic milk qualities, and establish a time for removal of processed milk, since such data, even if available in current literature, may need updating to obtain agreement between the Department of Health and the producers.

Additionally, producers should code date their products with date of pasteurization and reveal such codes to the Department of Health. These codes should perhaps be standardized to state the day and month of the year in a numerical fashion.

The implementation of date of shelf display, with day of week and month on individual cartons, will assure stock rotation in retail outlets. Anyone wishing to introduce expiry dating should do so only with Department of Health approval. The implementation of these regulations would permit the introduction of fluid milk by producers who wish to update their processing technology to produce items with longer shelf life. This might be considered by some members of the milk industry as a sales/marketing advantage over less competitive producers. Such practices might permit a reduction in milk costs to the consumer and producer--an added benefit to everyone.

VIII. FOOD PRODUCT ITEM LIST

A. Shelf Life--Food Industry Sources (FIS)

<u>Food item</u>	<u>Time*</u>	<u>FIS No.</u>
Buttermilk	5D	130
Canned milk	10-12M	30
Chocolate malted	Indefinite	130
Chocolate milk	7D	30
Condensed milk	6M	630
Eggnog	4-5D	130
Evaporated milk	12M	320
Fluid milk	8D	760
Fluid milk	5-7D	710
Yogurt	2W	130
Camembert	2-3D	130
Cottage cheese	15D	760
Cottage cheese	10-14D	30
Creamed cheese	90D	30
Parmesan	6M+	130
Romano	6M+	130
Ice cream	90D	30
Ice cream	90D	760
Ice cream	12W	580

<u>Food Item</u>	<u>Time*</u>	<u>FIS No.</u>
Dry products	1Y	170
Nonfat dry milk	Months	15
Sour cream	2W	130
Sour cream	1M	30
Sour cream	28D	760

*Y = year; M = month; W = week; D = day.

IX. RECOMMENDATIONS ON BEST MEANS OF FOOD QUALITY MAINTENANCE

Any recommendations on dating/coding must be considered on the basis of section VII, subsection C, above. If dating is practiced in New Jersey, some major changes should be made in the present "requirements," particularly with reference to enforcing compliance with requirements. The day and month (in English) would be a better and less confusing system of date stamping from the point of view of consumer information. Additionally, if New Jersey does not have the manpower to police its present laws, the laws should be repealed altogether.

(B) Refrigerated Fruit Juices

I. INTRODUCTORY REMARKS

These products include refrigerated orange juice, grapefruit juice, and modifications containing sweeteners and water. Fruit juices are estimated to constitute about 0.33 percent of supermarket sales. Orange juice is used as an example in the following discussion because of its popularity.

II. SUMMARY OF RECOMMENDATIONS

See section IX of this product group, and section II in product group (A) above.

III. TYPE OF FOOD AND PRODUCT GROUP

See section III in product group (A) above.

IV. TYPE OF PROCESSING AND PRESERVATION

The chilled orange juice sold in wax-coated or plastic-coated paper containers is prepared from frozen orange concentrate by dilution with fresh water to restore the juice to its original composition. It is kept below 50°F. and preferably at 40°F. during transportation and display for sale, and should also be kept refrigerated by the consumer until used.

For a discussion of the process used for concentrating and freezing the orange juice from which the "fresh" juice is made, see the section on "Juices" in the Frozen Food chapter of this report.

V. QUALITY CHARACTERISTICS

In addition to pleasing flavor, citrus juices are generally good sources of vitamin C (ascorbic acid). Table 3 shows the amount of ascorbic acid in freshly frozen orange juice and other citrus concentrations.

Table 3.--Analyses of concentrated citrus juices 1 day after concentrating and freezing

Variety	Date of process- ing	°Brix <u>1/</u>	Total acid <u>2/</u>	Maturity ratio <u>3/</u>	pH	Ascorbic acid
			Percent			Mg./100 gm.
Hamlin orange	1/26/50	42.3	2.78	15.2	3.6	205.8
Pineapple orange	2/15/50	42.1	2.98	14.1	3.7	211.5
Valencia orange	4/20/50	42.2	3.25	13.0	3.6	158.5
Dancy tangerine <u>4/</u>	1/25/50	42.1	2.93	14.4	3.6	73.9
Duncan grapefruit <u>4/</u> ...	2/21/50	42.1	4.64	9.1	3.1	136.2
Marsh grapefruit <u>4/</u> ...	2/28/50	41.9	4.03	10.4	3.3	129.4

1/ 28°C., corrected for acid.

2/ As anhydrous citric acid.

3/ Brix: acid.

4/ Sugar added before concentration to increase Brix: acid ratio. The Florida Citrus Code of 1949 prohibits the addition of sugar to frozen concentrated orange juice.

Source: From "Ascorbic Acid Retention in Frozen Concentrated Citrus Juices," Journal of the American Dietetic Association (10). Used with permission of the Association.

VI. PROCESSING AND STORAGE QUALITY LOSS FACTORS

The retention of vitamin C in citrus juices is high, both in the frozen concentrate and in the reconstituted juice prepared from the concentrates, as shown in the following tabulations.

Percentage retention of ascorbic acid in 42°Brix (fourfold)
concentrated citrus juices after storage for 12 months
at various temperatures

Storage temperature	Hamlin orange	Pine-apple orange	Valencia orange	Dancy tangerine	Duncan grapefruit	Marsh grapefruit	Average
-8°F.	100.0	98.7	99.2	94.0	98.4	98.8	98.2
10°F.	99.0	98.0	97.9	93.5	97.9	98.8	97.5
20°F.	98.7	96.7	96.7	90.7	98.1	98.3	96.5
32°F.	97.6	96.0	96.2	90.9	97.7	98.6	96.2
40°F.	97.1	94.7	95.9	89.9	97.1	97.1	95.3

Source: (10). Used with permission of the American Dietetic Association.

Percentage retention of ascorbic acid in reconstituted citrus
juices after storage for 2 days in a household electrical
refrigerator at approximately 50°F. 1/

Previous storage temperature of concentrate:	:	:	:	:	:	:	:
	Hamlin orange	Pine-apple orange	Valencia orange	Dancy tangerine	Duncan grapefruit	Marsh grapefruit	
	:	:	:	:	:	:	:
	:	----- <u>Percent</u> -----					:
	:	:	:	:	:	:	:
-8°F	97.8	95.8	95.4	92.7	98.0	96.3	
10°F.	94.5	94.7	94.7	91.2	97.4	96.6	
20°F.	96.5	95.6	94.8	94.6	99.7	98.3	
32°F.	96.5	95.5	95.1	92.4	98.1	96.2	
40°F.	98.1	95.6	94.8	91.9	96.7	95.7	
	:	:	:	:	:	:	:

1/ The reconstituted juices were prepared from 42°Brix (fourfold) concentrated citrus juices stored at various temperatures for 15-18 months.

Source: (10). Used with permission of the American Dietetic Association.

Any possible food poisoning organisms which might be present in the reconstituted juice are not likely to grow at refrigerator temperatures owing to their inactivity at low temperature and the acidity of the products. For the effects of temperature, see figure 4.

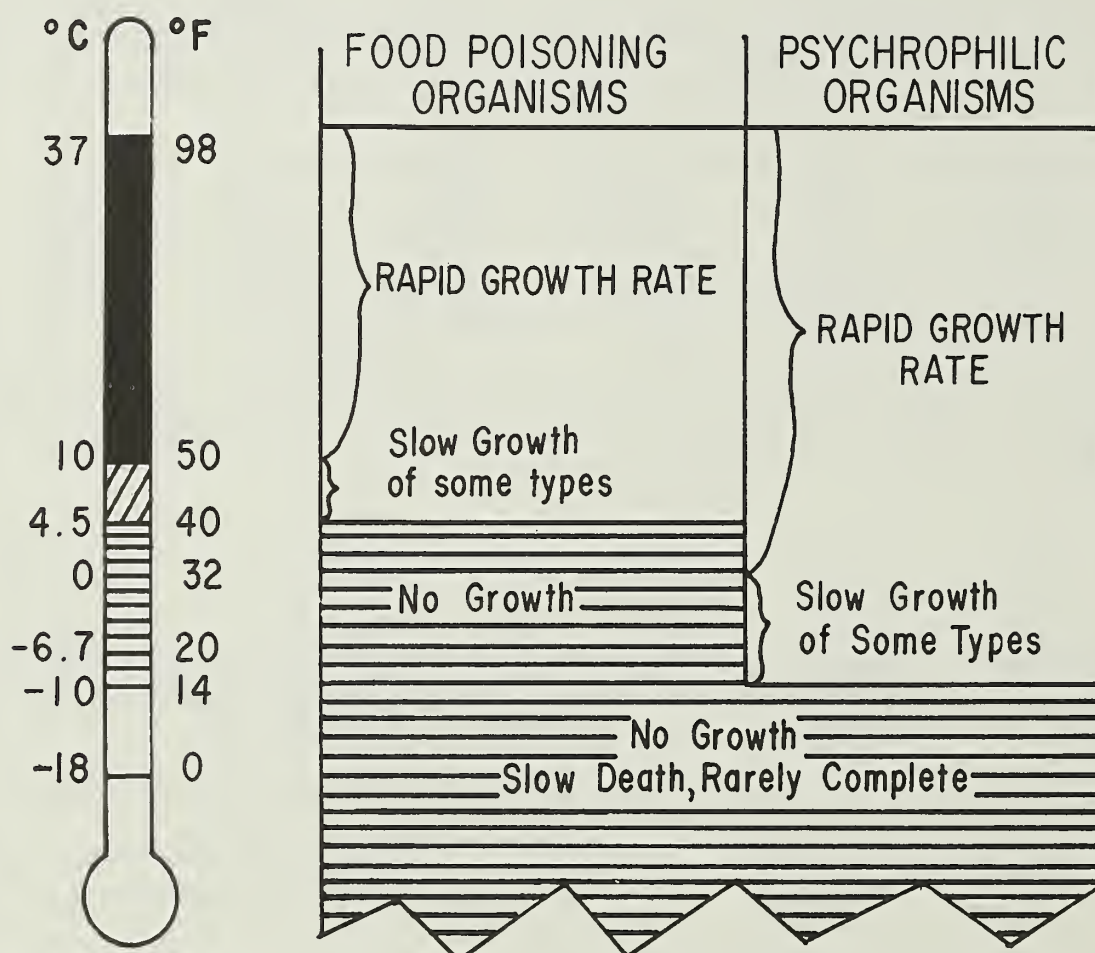


Figure 4.--Effects of temperature on quality of food

Source: Elliot and Michener (11).

VII. PRESENT PRACTICES OF CODE DATING/PUBLIC DATING

A. Voluntary Food Industry Code Dating and Monitoring

Food company #530FIS puts an expiry date on the top seal of its fruit drinks.

Another source (#960FIS) stated:

"This company uses many forms of product surveillance at a retail level:

"(a) Central Quality Control audits every three months at five different locations throughout the U.S.A. These are very complete inspections of product, packages, and label.

"(b) Sales/Marketing Department Surveys

"(c) Broker Surveys

"Our Marketing Department informs me that the turnover of our retail and wholesale inventories ranges from six to eight weeks."

B. Legal or Required Dating

1. Federal--See this subsection in product group (A) above.

2. State, Municipal, and Foreign--No requirements were noted.

C. How Coding/Dating Influences Quality Maintenance: Advantages and Disadvantages of Dating

The practice of coding by the food industry permits it to monitor its products based on a knowledge of product shelf life. The use of open expiry dating offers no advantages. Date of shelf display would help consumers rotate home stocks and assure stock rotation at the store level.

VIII. FOOD PRODUCT ITEM LIST

A. Shelf Life--Food Industry Sources (FIS)

Company #530 designates a 14-day shelf life for its fruit drinks, after which time the product is to be removed from sale.

IX. RECOMMENDATIONS ON BEST MEANS OF FOOD QUALITY MAINTENANCE

Because of the varying age of concentrates from which chilled juices are made, and owing to possible variations in refrigeration conditions during storage and display, no specific mandatory dating system is recommended. Coding and case marking is recommended for voluntary use by all producers to enable them to monitor their products.

Stamping of date of shelf display on individual packages is recommended to assure stock rotation in stores and in consumer homes.

X. REFERENCES

See section X in product group (D) below.

(C) Dips

I. INTRODUCTORY REMARKS

This group of specialty products accounts for only about 0.21 percent of supermarket sales. Miller (9) states that most dips are still made at home.

II. SUMMARY OF RECOMMENDATIONS

See section IX and this section in product group (A) above.

III. TYPE OF FOOD AND PRODUCT GROUP (also see this section in product group (A) above)

The formulation of dips is not standardized by any Federal standards of identity; consequently, there is no basic uniformity to their composition. However, these products are frequently made from sour cream, sour half and half, or nonfat dry milk. Some products may be made with a vegetable fat to replace all or part of the butterfat of the dairy products. Emulsifiers and stabilizers such as starch may be included. Various seasonings are added to complete the flavor and, according to Miller (9), onion flavor is the most popular.

IV. TYPE OF PROCESSING AND PRESERVATION

Although there is considerable diversity of formulation, the basic ingredients of dips are generally pasteurized, homogenized, and refrigerated. Some dips are flavored by adding a bacteria culture to develop the flavor. Other methods omit the culturing process and instead add acid directly to the mixture. Seasonings are blended into the mixture. Completed dips need refrigeration, preferably at 40°F. or lower.

V. QUALITY CHARACTERISTICS

Dips are used principally for their appetizer value and depend on characteristic flavors and smooth textures for their value. Textural consistency is a principal quality requirement. Dips must be agreeably soft but firm enough to not flow off snacks when dipped. If too firm, the dip will cause breakage of snacks.

While dips do contain considerable nourishment, they are generally not eaten for that purpose or with the intent of maintaining a balanced diet.

VI. PROCESSING AND STORAGE QUALITY LOSS FACTORS

Bacterial growth takes place slowly during storage, especially if storage temperatures should approach or exceed 50°F. These products are usually somewhat

acid, often pH 4.5 to 4.7, so there is little likelihood of pathogenic organisms developing under refrigeration. Since no standards are promulgated for these products, there is no positive control of acidity and, therefore, no control of bacterial growth. Off-odors and flavors may develop gradually.

VII. PRESENT PRACTICES OF CODE DATING/PUBLIC DATING

A. Voluntary Food Industry Code Dating and Monitoring

Company #530FIS dates its dips with an expiry date which determines the time they are to be removed from shelves.

B. Legal or Required Dating

See this section in product group (B) above.

C. How Dating Influences Quality Maintenance: Advantages and Disadvantages of Dating

See this section in product group (B) above.

VIII. FOOD PRODUCT ITEM LIST

A. Shelf Life--Food Industry Sources

Company #530FIS has assigned 21 days as permitted shelf life for sour cream dips, and 60 days for other dips.

IX. RECOMMENDATIONS ON BEST MEANS OF FOOD QUALITY MAINTENANCE

Since there are many variations in composition and storage conditions for these products, no specific mandatory dating or coding system is recommended. However, coding is recommended as an aid in monitoring products.

Open dating, in English, of shipping cases is recommended for stock rotation.

Stamping of date of shelf display on individual packages is recommended to assure stock rotation in stores and consumer premises.

The possibility of establishing quality control acidity (pH) levels for these products should be explored by the New Jersey Department of Health. Consumers should be advised that homemade dips should be prepared with due precautions for sanitary measures, refrigerated before use, and completely consumed or discarded.

(D) Simulated Dairy Products

I. INTRODUCTORY REMARKS

These products, which accounted for 0.11 percent of supermarket sales in 1968 (according to data calculated from statistics in Chain Store Age (1)), principally include the nondairy coffee whiteners intended to replace milk or half and half in hot beverages. They are available in both liquid and dried forms under various brand names. Other simulated dairy products are "filled milks" and "imitation" milks.

II. SUMMARY OF RECOMMENDATIONS

See section IX.

III. TYPE OF FOOD AND PRODUCT GROUPS (also see this section in product (A) above)

The coffee whiteners are generally made from nondairy components, whether sold in liquid or dried form. The principal ingredients of liquid coffee whiteners include a vegetable fat which is usually coconut oil; a protein material consisting of sodium caseinate or a soya derivative; an emulsifier or combination of emulsifiers, such as mono- and diglycerides; buffers such as disodium or dipotassium phosphate; a stabilizer such as carrageenan; a sweetener such as corn syrup solids; and water. When emulsified, the vegetable fat provides the whitening qualities. The protein material helps to maintain the emulsification. The emulsifier improves the whitening qualities, disperses the fat in the water, and assists in maintaining freeze-thaw stability. Buffer salts prevent "feathering" in hot coffee. The stabilizer serves to give body to the product and prevents separation of the mix (9).

Dry, instant dispersing coffee whiteners are composed of ingredients similar to the liquid products, but with some modifications. For instance, there is no need for a stabilizer such as carrageenan to prevent product separation.

Filled milk and imitation milk are intended to simulate fluid milk. However, there are differences in nomenclature for such products and in legal restrictions, in both Federal and State levels, with respect to labeling and shipping requirements in interstate commerce.

The product made from milk, cream, or skim milk and fats or oils other than milk fat is known as "filled milk" and is prohibited from entering interstate commerce by the Federal Filled Milk Act of 1923. However, a similar fluid product, which is composed of "...one or more edible fats or oils with not less than 8-1/4% milk solids - non-fat derived from fluid or dry product" (14), is permitted for sale as "imitation milk" within New Jersey.

However, fluid products containing ingredients somewhat similar to those in liquid coffee whiteners--sometimes designated as "imitation milk"--are not

permitted by this same New Jersey regulation to be called "imitation milk" or "the name of any fluid milk products," but must be labeled "by using a fanciful or brand name only" (14). The product may, optionally, be fortified with vitamins A and D.

IV. TYPE OF PROCESSING AND PRESERVATION

The fluid coffee whiteners and milk substitutes are customarily made by dispersing a stabilizer in cold water, adding the other ingredients, heating, homogenizing, and pasteurizing the product in the same way as milk. This is followed by rapid cooling to 40°F. and packaging into the containers developed for milk products. The products require refrigeration during storage, transportation, and display.

The dry coffee whiteners are assembled in a manner similar to that of other dried products, discussed in the Dry Foods chapter of this report. The dried products may be adequately stored at ambient temperature, but should be protected by reclosing the container when in household use.

V. QUALITY CHARACTERISTICS

The coffee whiteners, both fluid and dry, contribute some caloric and protein value, but are not ordinarily consumed for their food value. Rather, they are formulated to lighten the color of coffee and resemble the use of milk, cream, or half and half, modifying the predominant flavor of hot beverages. Some liquid whiteners are also offered for use as milk or half and half substitutes on cereals. When used in hot coffee, the whiteners must not coagulate or "feather." This occurrence is sometimes assumed by the consumer to be the result of souring, although the product is not sour. Such "feathering," which also may occur when regular dairy products are used, is the result of heat shock, and is guarded against by the addition of buffers.

The nutritional qualities of milk substitutes (filled milk, imitation milk, nondairy products) are described in detail in a special study by the Milk Industry Foundation, which made the following conclusion (12).

"It can generally be said that filled milks as we now know them are superior nutritionally to nondairy products as they now are appearing in the market place."3/

"As a broad general statement it might be said that the normal American adult may not suffer measurable nutritional deficiency by consuming filled milks or non-dairy beverages. However, in the opinion of some scientists, filled milks or non-dairy beverages may not be a suitable replacement for milk for certain segments of the population,

3/ Calcium in nonfat milk solids is ordinarily not compensated for in the latter.

specifically infants and children, the aged, and those with special dietary needs for milk."

VI. PROCESSING AND STORAGE QUALITY LOSS FACTORS

The fluid products may become sour if subjected to temperatures above refrigerator temperatures of 50°F., or to extended refrigerated storage of several weeks or more.

VII. PRESENT PRACTICES OF CODE DATING/PUBLIC DATING

A. Voluntary Food Industry Code Dating and Monitoring

Company #530FIS codes the date of production on the label of nondairy dry coffee whitener. This date is for stock rotation only. Quality change is considered virtually nonexistent for extended periods of time.

B. Legal or Required Dating

1. Federal--See this subsection in product group (A) above.
2. State and (3) Municipal--See Legal Report, appendix I.
4. Foreign--See Legal Report, appendix II.

VIII. FOOD PRODUCT ITEM LIST

A. Shelf Life--Food Industry Source

Dry coffee whitener: Company #530FIS states that quality changes are virtually nonexistent for extended periods of time.

B. Shelf Life--Scientific Source

Liquid coffee whitener: Miller (9) states that "Many of these foods can be kept indefinitely when frozen and several weeks under normal refrigeration."

IX. RECOMMENDATIONS ON BEST MEANS OF FOOD QUALITY MAINTENANCE

The nonsimilarity of the keeping quality of fluid "coffee whiteners" and "filled" or "imitation" milk to that of fluid milk is not sufficient reason to recommend the same dating recommendations made for fluid milk. Codes for the information of manufacturers should be used on all unit packages.

No public dating is recommended for packages since the dried packages are relatively stable. The date of manufacture should be applied to all cases and overwraps with coding on the unit packages.

Open dating, in English, of shipping cases, with coded date of manufacture of individual packages, is recommended to facilitate warehouse stock rotation of coffee whiteners and "imitation" milk. Stamping of the date of shelf display on individual packages is recommended for stock rotation in stores and consumer premises.

X. REFERENCES

- (1) Chain Store Age, 1969 Supermarket Sales Manual, Lebhar-Friedman, Inc., New York, N.Y., July 1969.
- (2) State of New Jersey, "Laws Governing the Production, Handling, and Distribution of Milk, Cream, and Milk Products," N.J.S.A. 24:10-57.1.
- (3) U.S. Department of Agriculture, Cheese Varieties, USDA Handbook No. 54, U.S. Government Printing Office, Washington, D.C.
- (4) New Jersey Department of Health, "Regulations Governing the Preparation and Handling of Frozen Desserts and Special Frozen Dietary Foods," M-D17, March 1965, Reg. No. 18.
- (5) U.S. Public Health Service, Grade "A" Pasteurized Milk Ordinance, 1965 Recommendations, Public Health Service Pub. No. 229, U.S. Government Printing Office, Washington, D.C.
- (6) Dahlberg, A. C., Influence of Dating Milk Containers on Retailing Milk in New York City Food Stores, Bulletin 927, Cornell University Agricultural Experiment Station, Ithaca, N.Y., March 1958.
- (7) American Society of Heating, Refrigerating, and Air-Conditioning Engineers, ASHRAE Guide and Data Book, Applications for 1966 and 1967, New York, N.Y.
- (8) Harris, R. S., and von Loesecke, H. (eds.), Nutritional Evaluation of Food Processing, John Wiley & Sons, Inc., New York, N.Y., 1960.
- (9) Miller, D. E., "Role of Dairy Substitutes," Journal of Dairy Science, Vol. 51, No. 8, 1968, pp. 1330-1334.
- (10) Huggart, R. L., et al., "Ascorbic Acid Retention in Frozen Concentrated Citrus Juices," Journal of the American Dietetic Association, Vol. 30, No. 7, July 1954, pp. 682-684.
- (11) Elliot, R. P., and Michener, H. D., "Review of the Microbiology of Foods," Report of Conference on Frozen Food Quality, Albany, Calif., November 4-5, 1960, Agr. Res. Serv., U.S. Department of Agriculture.
- (12) Milk Industry Foundation, Basics for the Milk Industry, Filled and Non-dairy Products, Special Study No. 2, Washington, D.C., February 1968, pp. 1-2.
- (13) Kleyn, D. H., Assoc. Prof. of Food Science, Rutgers University, New Brunswick, N.J., personal communication, 1969.

- (14) New Jersey Department of Health, "Regulations Relating to Imitation Lowfat Milk and Imitation Fluid Milk Products, and Products Made in Semblance of Such Products But Which Contain No Dairy Ingredients," M-D8, August 1968.
- (15) Glass, E. D., and Butz, W. T., Committee for Study of Milk Availability, Quality and Economic Considerations in the Dating of Milk, Special Report for the Milk Industry Foundation, Washington, D.C., February 1970.
- (16) Witter, L. D., et al., The Keeping Quality of Pasteurized Grade A Milk Offered for Sale in the Chicago Market, Bulletin 646, University of Illinois Agricultural Experiment Station, July 1959.

CANNED FOODS

I. INTRODUCTORY REMARKS

Canned foods were initially developed, as were many of today's commercial food products, because of military needs. The French Directory, a five-man governing board which ruled France in the late 1700's, offered a prize of 12,000 francs to the developer of a preserved food which would assure an adequate and proper food supply for the distantly deployed army and navy. In 1809, Nicolas Francois Appert offered the solution of a cooked food in a glass container. Appert had discovered the principle of sterilization by heat, and developed the art of heat processing. This constituted in the 19th century the most outstanding accomplishment in the history of food preservation (1).

With the invention of the tin can, canning, as it later was called, became one of the most widely accepted ways to preserve food--not only for the military forces, but also for the consumer and home preserver of foods. The term "canned foods" includes preserved foods packed in glass containers as well as in conventional metal cans. With all its problems, canning is still the best way to preserve foods. The food may be eaten right from the can with only preparatory heating, making it the earliest form of "instant foods." However, as shown later, canned food can deteriorate in quality under poor storage and handling conditions.

Most canned foods are processed (retorting) with sufficient heat to make them commercially sterile, so that they can be safely shipped and stored without refrigeration. There are a few exceptions to this rule. Some of the canned meat products require refrigeration after heat processing since they have been pasteurized (155°F.) to make them bacteriologically safe when stored as directed, but have been intentionally heated to less than complete sterilizing temperatures to preserve their aesthetic properties.

II. SUMMARY OF RECOMMENDATIONS (see also section IX)

A. Adoption by the New Jersey Department of Health of the Coding Recommendations of the FDA Good Manufacturing Practices, Federal Register, April 26, 1969, for processed foods. Disclosure of code meanings by food manufacturers to the New Jersey Department of Health on request by the latter.

B. Adoption of open date of manufacture labeling for all outer cases/overwraps, etc., to assist in stock rotation.

C. Voluntary coding of all individual containers in such cases/overwraps by the food industry with codes of their own choosing (similar in intent to A. above). Such codes should indicate plant location, date of manufacture of final product in container, shift, production line, and any other aspects of products, at the manufacturer's discretion.

D. Stamping of date of shelf display by retail stores for stock rotation and as a consumer aid in home storage stock rotation.

E. Storing of canned foods by industry and all other handlers at a maximum of 80°F., with a preference of 72°F. to maintain product quality. A further recommendation in this area is that canned products be cooled to at least 100°F. average internal temperature after processing before labeling and packing. Pasteurized canned meats should be stored at refrigeration temperatures (38°F.) and maintained at such temperatures until consumption. This could be supplemented with labeling instructions and appropriate placards in producers', distributors', and retailers' storage areas. Such products should be shipped by appropriate means at all times of the year to maintain such temperatures.

F. Expiry dating of pasteurized canned meats owing to their refrigeration requirement and generally short shelf life; this recommendation, however, must only be practiced if the policing action of E. can be maintained. The unit packs should be code dated with the date of manufacture in the new AMI (August 1969) code with two extra digits for the year (e.g., 082470, August 24, 1970).

III. TYPE OF FOOD AND PRODUCT GROUPS

Canned Foods, by product group, category, and variety

Product group	Percent-age of total sales	Product category	Percent-age of category sales	Percent-age of total sales	Product variety	Percent-age of department sales	Percent-age of total sales
Meat	1.14	Plain meats	31.8	.363	Lunch meat and tongue	9.3	.106
					Meat spreads	6.6	.075
					Vienna sausage	5.1	.058
					Chopped meats	4.7	.054
					Corned beef	3.9	.044
					Dried beef	.1	.013
					Frankfurters	.6	.007
					All other plain meats	.5	.006
						31.8	.363
		Italian dishes	20.5	.233	Canned spaghetti with meat	5.7	.065
					Canned spaghetti, other	6.7	.076

Source: Chain Store Age, 1969 Supermarket Sales Manual (13), Lebhar-Friedman, Inc., New York, N.Y., 1969. Used with permission of publisher.

Product group	Percent- age of total sales	Product category	Percent- age of category sales	Percent- age of total sales	Product variety	Percent- age of depart- ment sales	Percent- age of total sales
Meat (Cont.)					Canned macaroni with meat	2.4	.027
					Canned macaroni, other	1.0	.011
					Canned noodles (all types)	1.2	.014
					Ravioli, lasagna, and other Italian	3.5	.040
						<u>20.5</u>	<u>.233</u>
		Mexican dishes	16.4	.187	Canned chili	12.8	.146
					Other Spanish and Mexican	3.6	.041
						<u>16.4</u>	<u>.187</u>
		Prepared meat dishes	16.1	.184	Stews	7.2	.082
					Hash	5.5	.063
					Chopped meats with sauce	1.3	.015
					Sliced meats with sauce	1.1	.013
					All others	1.0	.011
						<u>16.1</u>	<u>.184</u>
		Oriental dishes	11.2	.128	Chow mein	2.9	.033
					Chinese dinners	2.1	.024
					Chinese noodles	2.1	.024
					Chinese vegetables	1.5	.017
					Chop suey	.4	.005
					All other Oriental	2.2	.025
						<u>11.2</u>	<u>.128</u>
		Plain poultry	2.7	.030	Boned poultry	1.6	.018
					Poultry spreads	.9	.010

Product group	Percent- age of total sales	Product category	Percent- age of category sales	Percent- age of total sales	Product variety	Percent- age of depart- ment sales	Percent- age of total sales
Meat (Cont.)					Whole poultry	.1	.001
					All other poultry	.1	.001
						<u>2.7</u>	<u>.030</u>
		Prepared poultry dishes	1.3	.015			
					Dinners	.4	.005
					Stews and other	.9	.010
			<u>100.0</u>	<u>1.140</u>		<u>1.3</u>	<u>.015</u>
Fish	1.02	Tuna	62.4	.636			
					Light	42.8	.436
					White	18.3	.187
					Specialties	1.3	.013
						<u>62.4</u>	<u>.636</u>
		Salmon	16.6	.169			
		Crab	7.7	.079			
					King	2.7	.028
					All other	5.0	.051
						<u>7.7</u>	<u>.079</u>
		Shrimp	4.6	.047			
		Sardines	4.6	.047			
		Clams	1.3	.013			
		Oysters	.8	.008			
					Wet-pack	.5	.005
					Smoked and other	.3	.003
						<u>.8</u>	<u>.008</u>
		Anchovies	.7	.007			
		Herring	.5	.005			
		Mackerel	.5	.005			
		All other canned fish products	.3	.003			
			<u>100.0</u>	<u>1.019</u>			

Product group	Percent- age of total sales	Product category	Percent- age of category sales	Percent- age of total sales	Product variety	Percent- age of depart- ment sales	Percent- age of total sales
Soup	.91						
		Canned, condensed soups <u>1/</u>	91.2	.809			
					Chicken noodle	12.3	.108
					Tomato, cream of tomato	12.2	.107
					Chicken rice, stars, etc.	8.8	.078
					Vegetable	7.2	.064
					Cream of mushroom	6.7	.060
					Vegetable beef	5.2	.046
					Broths	4.1	.036
					Turkey (all types)	3.4	.030
					Cream of chicken	3.2	.028
					Beef noodle	2.5	.022
					Clam chowder	2.5	.022
					Bean (all types)	2.3	.020
					Chicken vegetable	2.3	.020
					Vegetarian veg.	2.3	.020
					Beef	2.1	.018
					Pea	1.8	.016
					Minestrone	1.8	.016
					Tomato rice	1.6	.014
					Chicken gumbo	1.4	.014
					Consomme and bouillon	1.3	.015
					All other condensed	6.2	.055
						<u>91.2</u>	<u>.809</u>
		Canned, single strength soup	<u>8.8</u> 100.0	<u>.078</u> .887			

1/ Percentage of department sales from "Canned/Dry Soups,"
Chain Store Age (13).

Product group	Percent- age of total sales	Product category	Percent- age of category sales	Percent- age of total sales	Product variety	Percent- age of depart- ment sales	Percent- age of total sales
Milk	.27						
		Canned milk <u>2/</u>	100.0	.267			
					Evaporated	96.3	.257
					Condensed	3.7	.010
						<u>100.0</u>	<u>.267</u>
Fruit	1.29						
		Peaches	19.5	.252			
					Cling, sliced	8.8	.114
					Cling, halves	5.6	.072
					Freestone, sliced	2.6	.034
					Freestone, halves	1.2	.015
					All others	1.3	.017
						<u>19.5</u>	<u>.252</u>
		Applesauce	14.3	.185			
					Plain	12.3	.159
					Combinations	2.0	.026
						<u>14.3</u>	<u>.185</u>
		Pineapple	14.2	.183			
					Sliced	6.2	.080
					Crushed	4.0	.052
					Chunk	3.6	.046
					Spears and all other	.4	.005
						<u>14.2</u>	<u>.183</u>
		Fruit cocktail	13.0	.168			
		Pears	11.3	.146			
		Berries	11.1	.143			
					Cranberries and cranberry sauce	7.7	.100
					Cherries	2.2	.028
					All other	1.2	.015
						<u>11.1</u>	<u>.143</u>
		Citrus	5.0	.065			

2/ Percentage of department sales from "Canned/Dry Milk,"
Chain Store Age (13).

Product group	Percent- age of total sales	Product category	Percent- age of category sales	Percent- age of total sales	Product variety	Percent- age of depart- ment sales	Percent- age of total sales
Fruit (Cont.)		Apricots	3.6	.046			
		Pie fruits	3.2	.041			
		Plums	1.7	.021			
		Fruit salad	1.3	.017			
		Figs	.7	.009			
		Apples	.7	.009			
		All other fruit	.4	.005			
			<u>100.0</u>	<u>1.290</u>			
Juice	1.19	Fruit juices	48.1	.574			
					Prune juice	8.7	.104
					Apple juice	7.5	.089
					Grapefruit juice	7.5	.089
					Pineapple juice	5.0	.060
					Cranberry juice (including com- binations)	4.3	.051
					Grape juice	3.7	.044
					Orange juice	3.6	.043
					Lemon/lime juice	2.6	.031
					Nectars	2.0	.024
					Apple cider	.8	.010
					All other fruit	<u>2.4</u>	<u>.029</u>
						48.1	.574
		Fruit flavored drinks	34.6	.412			
					Grape	7.3	.087
					Orange	6.9	.082
					Punches	6.1	.073
					Pineapple/grape- fruit	4.2	.050
					Powdered break- fast drinks	4.1	.049

Product group	Percent- age of total sales	Product category	Percent- age of category sales	Percent- age of total sales	Product variety	Percent- age of depart- ment sales	Percent- age of total sales
Juice (Cont.)					Other combo drinks	3.2	.038
					Other single drinks	2.8	.033
						<u>34.6</u>	<u>.412</u>
		Vegetable juices	16.7	.197			
					Tomato juice	10.8	.126
					Vegetable cocktail	5.2	.062
					Tomato cocktail	.4	.005
					All other veg- etable juices	.3	.004
						<u>16.7</u>	<u>.197</u>
		Ades and bases	.6	.007			
			<u>100.0</u>	<u>1.190</u>			
Vegetables	2.56	Beans	15.4	.395			
					Green	9.1	.233
					Wax	1.2	.031
					Lima	1.1	.028
					Kidney	1.0	.026
					All other regular beans	3.0	.077
						<u>15.4</u>	<u>.395</u>
		Baked beans	13.1	.335			
					With pork	10.3	.264
					Barbecued	1.2	.030
					Vegetarian	1.1	.028
					With franks and other meat	.5	.013
						<u>13.1</u>	<u>.335</u>
		Tomato pastes	12.2	.312			
					Sauce	6.2	.159
					Pastes	4.7	.120
					Puree	1.3	.033
						<u>12.2</u>	<u>.312</u>

Product group	Percent- age of total sales	Product category	Percent- age of category sales	Percent- age of total sales	Product variety	Percent- age of depart- ment sales	Percent- age of total sales
Vegetables (Cont.)		Tomatoes	11.8	.302			
					Regular	7.7	.197
					Italian	1.8	.046
					Stewed and other	<u>2.3</u>	<u>.059</u>
						11.8	.302
		Corn	12.5	.320			
					Whole kernel	7.5	.192
					Cream style	4.8	.123
					All other	<u>.2</u>	<u>.005</u>
						12.5	.320
		Peas	9.4	.241			
					Regular green	8.4	.216
					Blackeye and field	.6	.015
					All other	<u>.4</u>	<u>.010</u>
						9.4	.241
		Mushrooms	4.6	.118			
		Asparagus	4.2	.108			
		Beets	2.7	.069			
		Yams and sweet potatoes	2.5	.064			
		Peas and carrots	2.2	.056			
		Sauerkraut	1.8	.046			
		Carrots	1.4	.036			
		Spinach	1.3	.033			
		White potatoes	1.0	.026			
		Onions	1.0	.026			
		Mixed vegetables	.8	.020			

Product group	Percent- age of total sales	Product category	Percent- age of category sales	Percent- age of total sales	Product variety	Percent- age of depart- ment sales	Percent- age of total sales
Vegetables (Cont.)		Cabbage	.4	.010			
		Pumpkin	.4	.010			
		Squash and zucchini	.2	.005			
		All other canned veg- etables	<u>1.1</u>	<u>.028</u>			
Total	8.38		100.0	2.560			

IV. TYPE OF PROCESSING AND PRESERVATION

The principles involved in canning are the placing of foods in hermetically sealed containers, destruction by heat of pathogenic and nonpathogenic organisms in cooking vessels (retorts), and cooling of the product to low temperatures of 100°F. or less. The equivalent of a temperature of 250°F. maintained for 3 minutes at the can center is generally required for low-acid foods (i.e., pH above 4.5).

The canning of fruits and vegetables involves the following steps after harvesting and delivery to the cannery: soaking, washing, sorting, grading, blanching, peeling, coring, heating, filling of cans or jars, sealing, retorting, cooling, labeling, and storage. The steps may be modified to suit various products and forms in which they are to be prepared, whether whole, sliced, cubed, with or without sauce, etc. The order of some of these steps may be altered for a variety of reasons.

Juices require some form of extraction from the fruit followed by straining before filling into the containers and proceeding with the retorting process; however, some acid juices are merely hot-filled and sealed.

Milk is concentrated under vacuum to reduce the changes which occur in color and flavor when directly subjected to high temperatures. Following evaporation, the milk is homogenized and fortified with vitamin D. Sugar is added after homogenization if sweetened condensed milk is being made. (However, according to Chain Store Age, the sale of evaporated milk in comparison with sweetened condensed milk has a ratio of 26 to 1.) When concentrated to approximately 2-1/4 times the solids in normal whole milk, this milk is either filled into cans, sealed, retorted, and cooled, or handled by the more recently adopted method which sterilizes the milk outside the can with a high-temperature, short-time (HTST) process, followed by filling aseptically into sterile cans which are then sealed.

For soups, the various components are assembled, and may be partly cooked or completely uncooked before filling into the containers and processed.

Meat and meat products, depending on variety, are sometimes precooked before canning; meat items such as sausage, spiced ham, and luncheon meat are not cooked before canning. Retorting is applied to most meat products. Canned hams, which are cured and may be smoked, are generally pasteurized (heated to 185°F. at the can center) and after cooling require refrigerated storage below 40°F.^{1/} These products, which are subjected to less intense heat treatment than necessary for complete bacteriological safety, require such processing to preserve a desirable texture and palatability of the product. These qualities would be degraded by the use of higher canning temperatures (212°F.).

Some types of fish are not cooked before canning, but depend completely on the sterilization process for their cooking. Other types are precooked before canning and sterilization.

The retorting time and temperature necessary to produce commercially sterile products depend both on the nature of the product and the size of the container. To destroy pathogenic bacteria, these processing conditions have been established in specific precise detail by the National Canners Association in cooperation with large can manufacturers and canners themselves. Low-acid (above pH 4.5) foods such as most vegetables, meat, and fish require pressure processing at high temperatures. Acid-type foods having a pH below 4.5 usually require lower temperatures, often about 212°F. These include fruits and fruit juices, sauerkraut, pickles, and relishes.^{2/}

Metal cans, glass jars, and bottles are handled in basically the same way, except that more care must be exercised in handling the latter to protect them from sudden temperature changes and mechanical shock damage.

No special low-temperature conditions are necessary for storage and transportation of canned foods, but 80°F. or lower is common industrial practice, although, as mentioned above, refrigeration is required for certain meat products and must be so designated on the label.

High-temperature storage and transportation of canned foods do not induce any health hazards. However, aesthetic quality changes--which are time and temperature dependent--can occur followed by nutritional losses. Many canned foods can withstand storage for 1 year before expert panels can detect changes; high-temperature storage is considered abnormal in the industry. The order of breakdown of quality in canned foods is: (1) flavor, (2) color, (3) texture, and (4) (much later) nutritive losses. The critical storage temperature for canned foods, depending on type, ranges from 80 to 84°F., which can induce aesthetic losses (4). However, many canned foods can withstand storage quite safely for 1 or more years at 100°F., but changes will occur (4).

^{1/} Hams in smaller can sizes (3 pounds and less) may be fully processed for shelf stability.

^{2/} The National Canners Association in Washington, D.C., can be contacted for more specific details.

V. QUALITY CHARACTERISTICS and VI. PROCESSING AND STORAGE QUALITY LOSS FACTORS

A. Marketing Quality Characteristics

1. Aesthetic--color, flavor, texture.
2. Nutritional--see below.

3. Microbiological--of little importance today, normally of processor interest only. (Batches of canned foods are microbiologically checked and retained by processor for 14-21 days minimum before they enter channels of distribution.)

4. Functional--container damage. In general, while canned items are usually consumed for nourishment, they are mainly judged by the consumer on the basis of flavor, color, texture, and interior appearance of the can.

B. Scientific Quality Characteristics

Selections of better canning grades to achieve aesthetic goals and retain nutritional properties are the subject of continuing research and investigation by universities and industries in the United States and abroad. Aesthetic concern is mainly directed to development of canning techniques which will cause less textural loss or change in canning through the use of higher temperatures (up to 270°F.) and shorter time processes. Nutritional studies continue in conjunction with this concern. Another area of concern is the development of analytical techniques to determine nutritional characteristics and establish pesticide residue levels in canned and other foodstuffs. Quality characteristics losses are considered further in the following section.

C. Product Groups

1. Vegetables and Fruits--According to The Heinz Handbook of Nutrition (5), canning by today's methods results in acceptable nutritional losses. There are no measurable losses of protein, fat, or carbohydrate.

The vitamin content of canned foods reflects the nutrient values of the raw materials used, as well as the methods used in preparation and processing. There are some losses of vitamins during the processing but no more than would occur in home kitchen preparation. As a result of improved methods, however, vitamins of raw foods are retained at a high degree in canned products. Table 4 shows how modest these losses are.

Nutritive losses during prolonged storage of canned foods are limited to the more vulnerable vitamins. In general, a 15 to 30-percent decrease in ascorbic acid may be expected if canned foods are stored for 1 year at 80°F., whereas only 5-15 percent is lost at 65°F., which is a more representative yearly average figure for most food warehouses in temperate climates (6). Depending on the pH of the food, thiamine losses are of a similar order of magnitude or somewhat larger. On the other hand, carotene, riboflavin, and niacin values decrease relatively slightly on storage.

Table 4.--Average percentage retention of certain vitamins, by selected commodities

Commodity	Ascorbic acid	Thiamine	Carotene	Riboflavin	Niacin
	-----Percent-----				
Asparagus	92	67	--	88	96
Corn	--	<u>1</u> /34	97	97	86
Green beans	55	71	87	96	92
Orange juice	98	--	--	--	--
Peaches	71	76	85	--	89
Tomato juice	67	89	67	100	98

1/ New method of pressure cooking, up to 90 percent.

Source: Adapted from The Heinz Handbook of Nutrition (5), 5th ed., copyright H. J. Heinz Company, 1959. Used with permission of H. J. Heinz Company.

The newer canning techniques of high-temperature, short-time processing permits retention of up to 90 percent thiamine. Since there are no standard storage temperatures prescribed for canned foods, nutritional losses vary, so that during a fixed period for all canned foods, losses are not predictable and depend on many factors.

Table 5 shows the percentage retention of some vitamins in canned foods stored at constant and fluctuating temperatures.

A major fruit canner (#280FIS) stated:

"Aging in canned pineapple is affected by time and temperature of storage. At 60°F. the rate of aging is relatively slow, whereas at 80°F. it is fairly rapid, and at 100°F. quality is seriously affected within four months. It has been rather conclusively demonstrated that the key factor influencing the rate of aging is the fructose content. The fructose occurs in small amounts in the fruit as harvested but comes primarily from the inversion of sucrose. Sucrose may be from the fruit or from added syrups. Factors which increase the rate of inversion therefore increase the rate of aging. These factors are high acidity, low pH, long storage, and high temperatures. There are other factors which have some influence on aging, however, they are relatively unimportant as compared with the fructose content."

Another major canner of fruits and vegetables (#300FIS) stated:

"Storage temperatures 20° or more above 60°F. reduce the shelf life of most of our canned products 25-50%. Storage temperatures below 80°F.

Table 5.--Percentage of vitamins retained in selected canned foods stored at constant and fluctuating temperatures

Temperature, °F.		Peas		Orange juice		Tomatoes	
Range	Average	Ascorbic acid	Thiamine	Carotene	Ascorbic acid	Thiamine	Ascorbic acid
-----Percent-----							
<u>12 months</u>							
Controlled	50	93	92	98	97	100	95
Controlled	65	91	87	94	92	98	94
Controlled	80	86	74	91	77	89	82
30-78	58	93	91	97	96	98	106
28-92	59	96	89	98	90	99	98
36-87	61	98	96	98	91	95	101
42-79	63	96	90	98	91	103	101
51-87	66	94	92	100	92	96	102
54-104	70	94	85	97	86	99	105
50-92	72	92	89	100	81	99	100
54-91	77	96	85	97	81	95	92
50-98	77	92	83	97	73	96	83
<u>24 months</u>							
Controlled	50	91	90	94	95	101	89
Controlled	65	89	85	91	80	89	87
Controlled	80	81	70	90	50	83	70
30-78	58	94	90	97	85	96	99
28-92	59	92	88	98	84	95	102
36-87	61	93	88	95	82	99	93
42-79	63	93	86	96	76	99	101
51-87	66	92	87	95	77	97	85
54-104	70	89	79	93	77	91	104
50-92	72	90	82	96	70	91	86
54-91	77	88	82	96	57	81	86
50-98	77	90	77	96	59	78	84

Source: J. F. Feaster from "Foods of Plant Origin" (7) in Nutritional Evaluation of Food Processing, by R. S. Harris and H. von Loesecke (eds.). Feaster adapted data of Guerrant, et al. (8) to Moschetti, et al. (9). Used in this report with permission of R. S. Harris who holds copyright to Nutritional Evaluation of Food Processing.

do not change the nutritive value of our canned products except for Vitamin C. No chemical or microbial deterioration will appear in any of our canned foods if the storage temperature does not rise higher than 90°F. Prolonged storage at low temperatures (25-35°F.) will cause syneresis or weeping in products which contain certain types of starches."

2. Juices--Vegetable and fruit juices respond about the same way to canning in metal and glass as do the aforementioned vegetables and fruit themselves. However, canned orange juice undergoes a noticeable flavor change during heat processing.

3. Meats--According to Schweigert and Lushbough (10), the retention of thiamine may be only 20 to 33 percent after canning meat, but there is little if any loss of riboflavin and niacin.

At temperatures lower than those required for commercial sterilization, less destruction of vitamins takes place. The digestibility of the protein is damaged during sterilization, but no actual loss of protein occurs. For instance, tests show that canning of meat may lead to lower digestibility of beef--98-94 percent.

During prolonged storage (up to 31 weeks) at 98°F., there was little or no loss of riboflavin, niacin, and pantothenic acid, according to Schweigert and Lushbough (10). However, there is a loss of thiamine and riboflavin during extended periods of storage at 100°F. This loss applies principally to plain meats, and not necessarily to the various combinations, such as prepared dishes, stews, etc.

Nutritive and other losses are slight in pasteurized meats, which receive a lower heat treatment in processing and require refrigeration after processing until consumption.

4. Fish--The losses of nutritive value that occur during fish canning are economically unavoidable because they are the result of such operations as trimming. Nutritional losses during storage of canned fish are not considered significant, but further losses often occur when the products are opened, and much of the free liquid, which may contain protein and vitamins, is discarded.

5. Canned Soups--Soups are normally a mixture of ingredients which are cooked at one or more stages during processing, resulting in a varied assortment of constituents. The large canners have determined the content of the significant nutrients in all of their canned products, including soups.

Except for the frozen soups, which are discussed under frozen foods, all canned soups are commercially sterile and pose no health hazards due to storage.

6. Evaporated Milk--According to the U.S. Standards of Identity, this product is evaporated to contain not less than 7.9 percent milk fat and not less than 25.9 percent total milk solids. It may contain certain phosphates, citrates, chlorides, and carrageenin for stabilization. It may be fortified with vitamin D to contain not less than 25 U.S.P. units per fluid ounce (29.6cc).

Despite significant physicochemical changes taking place during the evaporation process, the overall nutritional value of evaporated milk is still very high. While there are changes in the protein taking place, it is generally more readily digestible when taken as evaporated milk than as fresh milk. According to Wanner (11), processing has no significant effect on vitamin A. The effect on vitamin D is unimportant because most canned evaporated milk is fortified with this vitamin. Thiamine losses range from 14 to 27 percent. Little or no loss of niacin occurs; about 60 percent of the ascorbic acid is lost during evaporation. However, Morgan (12) states that vitamin A, carotene, and riboflavin contents of evaporated milk have been shown to be almost completely retained during storage of 1 year at 90°F. or 6 months at 100°F.

7. Canned Sweetened Condensed Milk--According to the U.S. Standards of Identity, this product is condensed to contain at least 8.5 percent milk fat and 28 percent total milk solids. It undergoes considerably less drastic heat treatment than does evaporated milk because it is not sterilized but rather is preserved by the addition of sufficient sugar to make it bacteriologically stable.

There are also some physicochemical changes taking place during the processing of sweetened condensed milk, but here, too, the protein is more digestible when taken from this milk than from fresh milk. Vitamins A and D are not affected by processing; riboflavin also seems to be unaffected. Niacin losses can range from 10 to 15 percent, and ascorbic acid loss can be 10-33 percent.

Other changes taking place during storage of sweetened condensed milk are very gradual and include darkening, increase of a stale flavor, and separation of a cream layer during quiescent storage.

Some companies provided information on the foregoing matters. The following information mainly concerns evaporated milk, but some similar changes occur in canned condensed sweetened milk. Company #30FIS stated:

"These changes are quite subtle, are slow to develop, and it is very difficult to say just where the life of such a product ends. Before the use of carrageenin in canned milk, about 5 years ago, separation at the end of one year was quite serious, because the separated cream layer could not be reincorporated readily. When shaken vigorously, firm cream lumps were evident which the customer invariably objected to because she felt the product was sour. However, with the use of carrageenin, a heavy cream layer does not form and the cream that does rise to surface forms a light non-compact cream layer which may be readily reincorporated into the product. We prefer to have our evaporated milk light and creamy in appearance, relatively free from stale flavor, and, for this reason, we maintain a policy of a relatively short shelf life for this product even though it may be used safely for many months beyond this date.

"Our stores are allowed 4 months to move the product from the shelves. This product has an additional shelf life of 6-8 months beyond that date."

Another food industry source (#320FIS) wrote:

"Under these normal circumstances we would expect a minimum shelf life of twelve months. In the past it was necessary to turn evaporated milk in storage periodically to avoid a slight separation of the butterfat. However, this defect is no longer a serious problem inasmuch as all manufacturers are adding carrageenin which prevents fat separation."

Number 710FIS stated:

"The quality factors used in controlling acceptable shelf life are based on shelf life studies prior to new product introduction and upon experience in the market place.

"As you well know, the shelf life varies considerably with the different types of products. At one extreme would be the conventionally sterilized products such as evaporated milk. Here we have [many] years experience in developing product and equating this with acceptable shelf life under a wide range of conditions. . . .It is our practice to store new products under various conditions of temperature and humidity (many at extreme conditions) prior to writing final specifications and releasing of product for market distribution. I think this is standard practice among the major food firms."

D. Container Effects on Quality Losses

Because of varying chemical and physical compositions of canned products, the type of can which best fits the product, with respect to kind and amount of lining material, is chosen on the basis of past industrial experience. The nonacid foods generally do not attack the can liners/lacquers and during long storage will produce, even with slight reactions, only minor flavor losses. There may be a gradual change in color in some products or flavor in others, but the general palatability usually remains good for several years unless high storage temperatures have been maintained (80°F. or above) for lengthy periods, and provided also that suitable type cans have been used and that processing has complied with established methods and controls.

In canned meats, there may be some attack with time on the enamel of the interior of the can or on the tinplate by the free fatty acids and salts present in the meats. This causes discoloration of the can interior, but it does not cause a health hazard. Meats which have been commercially sterilized according to accepted practices are bacteriologically safe and remain so until opened.

Cans containing acid foods, such as sauerkraut, may show can failure. Acid may eventually perforate the can and cause leaking, or hydrogen gas may form and swell the can ends. This is rather unusual. Such cans, while not health hazards, are best discarded by the consumer or returned to retail stores.

Bacteriological spoilage, resulting in such effects as gas formation accompanying souring, or souring without gas formation (flat sour), is not the result of storage time alone, but is primarily caused by some processing irregularity, such as understerilization in retorting, malfunctioning of can sealing equipment, or rough handling resulting in leakage through seams or seals.

Can swells may also appear during storage owing to overfilling or filling at lower than usual temperature. Products packed in glass are not altogether free from failure because their caps are normally of metal and may be subject to some of the same difficulties faced by metal cans. Closure failures may occur, but any resulting product degradation does not have a primary relationship to storage time. Some foods packed in glass may suffer color quality losses if exposed to light.

While can manufacturers produce cans designed to be suitable for specific foods and food groups, individual canners decide on the particular can for their use, sometimes allowing their choices to be dictated by desire for economy. Some cans, therefore, are more likely to result in product degradation sooner than others, even though their contents remain edible and do not constitute a health hazard.

In response to questions on the above, a major canner (#165FIS) supplied the following information:

"This company has a comprehensive program to insure that satisfactory products are always available to our customers. This program is probably similar to those of other reputable food packers who are interested in repeat sales of their products. Some food packers have large investments in brand names, and thus are diligent in efforts to gain and maintain consumer satisfaction and loyalty in order to generate repeat purchases, which are essential to the life of the business.

"Listed below is a description of the various steps taken by us to insure that the product, as consumed, is of satisfactory quality. There is much more to the program than merely the establishment of maximum shelf life."

New Product Development

"When a product is developed, one part of the research is to store samples of canned product under various conditions of time, temperature, and humidity in several different containers. At specified time intervals the product is examined for flavor, odor, color, consistency, and other quality factors. The product is analyzed for metal pick-up and the container itself is examined and tested for change in the container....

"All current canned food products packed in conventional cans have a corrosion service life of at least 36 months and many are satisfactory for longer times as determined by [our] procedure. We do not claim longer shelf life on these products because products over 36 months old may be somewhat degraded in color and flavor, or the container may show signs of corrosion. However, products over 36 months old are perfectly safe to eat; they may not meet our standards of quality but are still good food. In most instances, the consumer of the food would not be able to differentiate between different ages of the food until more than 3 years have elapsed.

PROCEDURE FOR DETERMINING SHELF LIFE OF CANNED FOOD PRODUCTS

"Factory packs are made on each new product and each major formula change. A 150-200 can sample is divided: 100 cans for storage at 70°F. for 36 months, 50 cans for storage at 100°F. for 18 months, and 12-24 cans for storage at 120°F. for 12 weeks.

"The 12-week storage at 120°F. provides an acceleration of 10:1 over 70°F. storage. We consider 12 weeks at 120°F. to approximate 120 weeks storage at 70°F. This rate is estimated from the tin and iron pickup in the product. This is an average figure. There is some variation depending on the activity of the product.

"The 120°F. packs provide an early indication of corrosion and product reactions on the container.

"The 18-month storage at 100°F. provides an acceleration of 2 or 3 to 1 over the 70°F. packs. Any product successfully passing the 18 months storage at 100°F. will usually be the equivalent of more than three years storage at 70°F.

"The 100°F. storage at 18 months allows us to evaluate the effects of abusive storage in the trade and provides an accelerated means of predicting the corrosion effects of the product on the container and the stability of product quality and color.

"The 70°F. storage at 36 months allows us to determine corrosion service life, product quality and color under close to normal conditions. The 70°F. packs are the ones used to follow flavor changes.

Production Planning

"It is very important that production planning for a product is accurate in order that production volume will fill the pipeline of normal warehouse and retail inventories. This is desirable from the quality standpoint of the finished product and is also self-limiting for economic reasons. These economic factors are: excess storage costs, interest on investment, fading of colors on cases and labels. It should be recognized that seasonal packs must be on a year's supply basis. However, this is an advantage to the consumer, since this is the reason why the U.S. food supply is so superior and diet is so varied when compared to many countries. Manufacturing volume of each product is based on inventory and estimated sales. The amount of production is limited to the amount necessary to meet these requirements. In some instances, an annual planned out-of-stock condition is built into the manufacturing schedule.

Warehouse Control

"Warehouse inventories are shipped on a first-in, first-out basis to insure that old product is not by-passed in the warehouse.

"Time limits in our warehouse range from 4 months to 12 months depending on the product and performance of the container. In a few cases this storage limit is increased by storing at 40°F. temperatures. These storage times are based to a considerable extent on container performance, although product quality is evaluated along with container evaluation. This plan permits more than 2 years for these products to reach the consumer in prime condition."

E. Retailing Storage and Display

A major meat canner (#680FIS) stated:

"Our recommendation to the retailers is that our products be maintained and displayed at a maximum of 40°F....Pasteurized canned meat products, such as canned hams, are water cooked to a minimum of 155°F. and chilled to less than 40°F. for storage and distribution. Of course, this treatment does not kill spores and it is necessary to maintain these products in a refrigerated environment as with the packaged products described above."

Another meat canner (#477FIS) stated:

"Our product is not only canned so it is not visible while on display, but also the processing techniques provide it with the characteristics that are required in order to sell the product through the normal grocery distribution channels. In other words, ours is a shelf stable product that requires no refrigeration and has an almost unlimited shelf life, if held under normal conditions."

F. Consumer Factors

With respect to consumer home storage, canner #165FIS stated:

"The best storage for canned foods is in a dry place at moderately cool, but not freezing temperatures. Storage near steam pipes, radiators, furnaces, and kitchen ranges should therefore be avoided.

"Canned foods will keep as long as nothing happens to the container to make it leak. Extremely long periods of storage at high temperatures may cause some loss in color, flavor, appearance, and nutritive value but the foods will remain wholesome. We [recommend] a regular turnover in the home about once a year."

VII. PRESENT PRACTICES OF CODE DATING/PUBLIC DATING

A. Voluntary Food Industry Code Dating and Monitoring

The food industry does not practice open public dating. Companies who were surveyed code dated their cans in the following manner:

Vegetables

Company #530FIS--code dates day of manufacture, embossed on end of can.

Company #470FIS--code dates containers with packing date; has schedule of time limit for warehouse and distribution; each item specified.

Company #165FIS--codes each product to show date of pack and plant.

Company #460FIS--codes all products to show packing location, year, month, day, and sometimes time of day.

Company #720FIS--codes each can and case; presently coding cases of glass containers; experimenting with coding caps for glass containers; plans to code individual glass containers soon.

Company #480FIS--codes packages to designate product, plant, and often the line, date, and time.

Fruits and Juices

Company #470FIS--code dates containers with packing dates; has schedule of time limit for warehouse and distribution; each item specified.

Company #165FIS--codes each product to show date of pack and plant.

Company #720FIS--codes each can and case; presently coding cases containing glass containers.

Company #480FIS--codes packages to designate product, plant, and often the line, date, and time.

Meats

Company #530FIS--code dates day of manufacture, embossed on end of can.

Company #680FIS--code dates "control" or expiry date on packages.

Fish

Company #470FIS--code dates cans with packing dates; has schedule of time limit for warehouse and distribution; each item specified.

Soups

Company #470FIS--code dates cans with packing dates; has schedule of time limit for warehouse and distribution; each item specified.

Soups (Cont.)

Company #165FIS--codes each product to show date of pack and plant.

Company #630FIS--codes individual cans with year, day of year, plant, batch, and product.

Milk

Company # 30FIS--code dates cans.

Company #630FIS--codes individual cans with year, day of year, plant, batch, and product.

The following are some other industrial practices and methods of monitoring used by company #720FIS:

"We plan to sell all products in 1-1/2 years under [our] label and we have at least 2 years shelf-life."

"We sell to Bents & Dents our old poor color, etc. on reduced price if edible. Destroy inedible (every can)."

"No out-dated recall system"

"On glass the code is not present on the individual container but is on all cases. We are experimenting with glass cap coders on catsup this year and hope to use them in 1970 to comply with G.M.P."

On shelf life testing, this company stated:

"Actual storage of samples is for 3 years, however in new products we store them 6 months [at] 100°F. = 1 year and 3 months [at] 120°F. = 1 year and then shoot for one year minimum shelf life. Either flavor or color deteriorates. In tin it's usually flavor and in glass it's color."

Another industry source (#155FIS) stated:

"Tuna is a U.S. Food and Drug standardized food. Adherence to these standards is monitored by the Food and Drug. Our Quality Control program starts with the raw material and is followed very closely by the Quality Control people in each plant through the various processing steps. The retail stores are checked by a salesman and any dented cans, unlabeled or rusty cans, are replaced."

A major canning company with national and international distribution (#470FIS) sent complete information on its extremely detailed monitoring schemes. The company classifies foods into groups based on shelf life tests. They require regular inventory examination of their canned products at given time intervals. Each product has a maturing age (e.g., 12, 18, 24, 36 months), and the product requires examination at these times. Then special sales action is required at 18 or 24 months of age--depending on its nature--with pickup and destruction by 24 or 36 months of age. The plant manager is

responsible for stock inventory and reports on its status to the company headquarters and to a special corporate coordinator of stocks.

Company #470FIS stated:

"There are many factors which will influence the stability/storage/shelf life of consumer foods. We are constantly auditing our products and revising our shelf life policies as required.

"We list some of the things which can extend or reduce our shelf life:

- | | |
|-----------------------------|-------------------------|
| 1. Recipe modifications | 4. Processing variables |
| 2. Container specifications | 5. Storage temperatures |
| 3. Ingredient variables | 6. Storage humidity." |

B. Legal or Required Dating

1. Federal--There are no Federal requirements for public dating on canned foods. The FDA regulations contained in the Federal Register, April 26, 1969, Good Manufacturing Practices, indicate that FDA would like code dating for interstate and intrastate commerce shipments.

There are many Federal requirements and grades of canned foods, which will not be discussed in this report. The National Cannery Association in Washington, D.C., cooperates with industry and government in promulgating such standards. Information on these requirements can be obtained from the Association or from the USDA.

2. State and (3) Municipalities 3/--The States of California, Washington, Michigan, Minnesota, Connecticut, Arkansas, Indiana, and Louisiana have canned products "requirements" with respect to date coding of canned products. California Public Health Title 17, Register 54, #16, 7-31-54, states in 12470 and 12475:

"12470. Record of Cooks. Each licensed retort operator shall keep a record of the cooks as required by the State Board of Public Health.

"(a) The original and a duplicate of the production record must be kept by filling in accurately in complete detail the form approved by the Department of Public Health. Each entry in the record must be made by the operator at the time the specific retort operation is observed and not copied afterward. It must be in legible handwriting and be signed by the operator or operators.

"(b) Chart of recording thermometer must show full time and temperature as required, otherwise the product will be restrained.

"(c) Each production record and recording thermometer chart shall be

3/ See also Legal Report, appendix I.

stamped, initialed and numbered by a state cannery inspector before use and must be accounted for.

- "(d) The cook or batch number and size of cans involved must be recorded by the canner in each respective curve of all temperature charts.
- "(e) Production records and charts must be scrutinized and checked by a state cannery inspector before product is released for shipment."

"12475. Coding. (a) Each plant must submit and have approved a code to appear legibly on the cover of each container. This code will show the plant where packed, year packed, the product contained therein, batch number or day code. It is understood by the packer that where a day code is used, the entire day's output shall be considered as one batch in case of question. If a container such as a glass bottle be used and the cap or cover be too small to permit the coding to be embossed or ink-stamped thereon, it shall be permissible to legibly perforate or ink-stamp the required code on the label, providing the label is securely affixed to the container."

The State of Washington, Department of Agriculture, Order 1071, states:

"Regulation 8. Records

- "(1) Coding. Each cannery must submit to the department a code to appear legibly on the surface of each container that will identify the packer. This code will show the plant where packed, year packed, the product contained therein, batch number or day code. It is understood by the packer that where the container coding to identify each day's production does not identify production for specific periods of the day that the entire day's production shall be considered as one batch in question.
- "(2) Process record. Each licensee shall keep a daily process record on an approved form, filled in at the time the specific retort operation is observed. The record shall be separate for each batch load and shall include the product, the batch number, the code and the size of containers in each batch, the approximate number of containers in each batch, the processing time and temperature for each batch, and the readings of the recording thermometer, the indicating thermometer, and the pressure gauge for each batch taken after the proper process temperature has been reached.
- "(3) Recording temperature chart record. Each chart of the recording thermometer shall show the full time and temperature as required for each batch, and the batch number shall be recorded in each respective curve of the chart at the end of each day's operation.

"(4) Filing records. Each process record and recording thermometer chart shall be dated and signed by authorized company personnel, shall be held for not less than 24 months, and shall at all times during this period be available to the department."

A food industry source (#300FIS) provided the following information:

"[The] State of Connecticut requires an identifying number usually consisting of the abbreviation of CT followed by a plant number as for example - CT 316. This number must appear either as a part of the can code or the label of any non-alcoholic juice or beverage sold in the State of Connecticut. This number identifies the location of the food processor's plant.

"The States of Michigan and Minnesota require the listing of the City and State where non-alcoholic juice drinks and beverages are manufactured. If the packing firm's executive offices and processing plant are at the same location, only one address is required.

"While some states do require code letters or code numbers on canned juices and drinks we know of no other legal requirements with respect to [open] date labeling in states or municipalities."

Arkansas and Louisiana require coding of date and year of canning; Indiana requires similar coding of canned meat.

The Georgia Department of Agriculture Regulation which follows, is applicable to wholesale grocery stores:

"40-35-52. REFRIGERATION. All readily perishable foods, excluding fresh produce, but including canned hams marked 'Perishable,' and all hams not dry salt cured shall be kept at air temperature of 40 degrees F. or below. (Authority: Ga. Laws 1956, p. 195 as amended)"

4. Foreign--Requirements of foreign countries vary; all "require" code dating and some "require" open expiry dating of canned goods (see Legal Report, appendix II).

C. How Dating Influences Quality Maintenance: Advantages and Disadvantages of Dating

As stated before, public dating cannot regulate or assure proper handling and thus can accomplish little with respect to quality maintenance.

Code dating may be more effective when used as a tool by a concerned and profit-motivated industry to prevent old stocks from reaching the consumer.

The shelf life of canned foods, more so than most other foods, varies widely from company to company. Overall quality is time and temperature dependent and, as in the case of frozen foods, there are no distinct storage requirements for all processors to follow.

Manufacturing and handling defects may occur in canned meat products, but the resulting abnormal deterioration has no primary relationship to age, and dating would not assure protection against possible resultant hazards.

The pasteurized canned meat products requiring constant refrigeration are not sterile. Commercial experience with these products has been good, but apparently there is no complete assurance that a badly abused can--i.e., one which fails to be refrigerated at all times--rather than a physically damaged one, could not constitute a health hazard. A date of manufacture or of expiry would not reveal the lack of proper refrigeration maintenance which might have taken place, but could perhaps assure stock rotation in channels of distribution and at the retail store levels, since this product has a relatively short shelf life of 1 year.

VIII. FOOD PRODUCT ITEM LIST

A. Shelf Life--Food Industry Sources (FIS)

<u>Food item</u>	<u>Time*</u>	<u>FIS No.</u>
Apple sauce (at 70°F., low-calorie product)	12-16M	300
Apricots	3Y	480
Asparagus	2Y	720
Asparagus	1-1/2-3Y	460
Beans (chile)	3Y	480
Beans (kidney)	3Y	480
Beans (and pork)	4Y	720
Beans (and pork)	3Y	480
Beans (small red)	4Y	480
Canned foods	Many years	460
Canned foods	2-3Y	470
Canned foods	Unlimited	477
Canned foods	Indefinite	425
Canned foods	3Y	165
Catsup	2Y	720
Citrus fruits	13M	520
Fish	2Y	200
Fish	5Y	470
Fish	Indefinite	155
Fruit cocktail	3Y	480
Fruit, general	2Y	200
Fruit (varies with item)	1-2Y	470
Fruit juice (at 70°F., low-calorie product)	3-6M	300
Fruit and vegetable juices (can)	2Y	720
Fruit and vegetable juices (glass)	3Y	720

*Y = year; M = month.

<u>Food item</u>	<u>Time</u>	<u>FIS No.</u>
Fruit drink (specialty)	6M	720
Fruit drinks (at 70°F., low-calorie product)	3-6M	300
Juice, prune (at 70°F., low-calorie product)	12-16M	300
Meat	Ext. shelf life	530
Meat	2Y	200
Meat (pasteurized)	4-8M	680
	(store turnover time)	
Meat (sterilized products)	1Y	680
	(store turnover time)	
Milk, canned	1Y	320
Milk, canned		
Store shelf life	4M	30
Home storage	6-8M	30
Total	10-12M	30
Milk, sweetened, condensed	6M	630
Mincemeat	18M	630
Peaches	3Y	480
Pears	3Y	480
Peppers	2Y	720
Potatoes	48M	480
Prunes (at 70°F., low-calorie product)	15M	300
Prune juice (at 70°F., low-calorie product)	12-16M	300
Relish	2Y	720
Soups (specialty, premium, gourmet)	9-15M	630
Soup (turnover time before sale)	1Y	30
Soup (varies with item)	13-36M	470
Spinach	4Y	480
Tomatoes, Italian	30M	480
Tomato juice	2Y	720
Tomato juice	36M	480
Tomatoes, sliced	30M	480
Tomatoes, stewed	3Y	480
Tomato wedges	30M	480
Tomatoes, whole	30M	480
Vegetables	2Y	200
Vegetables	1Y	105
Vegetables	2Y	470
(varies with specific item)		

IX. RECOMMENDATIONS ON BEST MEANS OF FOOD QUALITY MAINTENANCE

Open case coding is recommended for all canned goods to facilitate and encourage stock rotation by all channels of distribution and personnel handling them in the retail stores.

Sterilized canned foods have a long shelf life, but it is not economical for goods to occupy warehouses and store shelves for long periods of time. The date of shelf display would assist the merchant in rotating his stock as well as serving its primary purpose of assisting the consumer to rotate her stock. Observations indicate that most, if not all, canners currently code date the ends of each can produced, and thus may have adequate control over the history of their products. Storage of canned foods at lower than 80°F. at all times, and preferably at less than 72°F., is recommended.

Pasteurized meats, which require constant refrigeration, should ideally be dated with an expiry date because of their relative short shelf life in the canned food category. However, use of an expiry date would give a false sense of security because cans of these products might become completely unusable if they should be unrefrigerated, which could occur long before the arrival of any designated expiry date. (Products from abroad should also be considered in this particular light.)

Placards should be posted in warehouses and stores, directing employees as well as consumers to keep such pasteurized meat products refrigerated to under 50°F. and preferably at 40°F. until consumed.

The consumer should be more cautious in handling canned foods, which are viewed by some as having an indefinite shelf life. In this respect, the survey team endorses the advice of one industrial source (#165FIS): "We recommend a regular turnover in the house of about once a year."

X. REFERENCES

- (1) Ball, C. O., and Olsen, F. C. W., Sterilization in Food Technology, 1st ed., McGraw-Hill Book Company, Inc., New York, N.Y., 1957.
- (2) Schmitt, H. P., "Commercial Sterilization in Canned Foods--Its Meaning and Determination," AFDOUS, Vol. 30, No. 3, 1966.
- (3) Cohen, E. H., "Determination of Acid Phosphatase Activity in Canned Hams as an Indicator of Temperatures Attained During Cooking," Food Technology, Vol. 23, 1969, p. 104.
- (4) Henick, A. S., U.S. Army Natick Laboratories, personal communications, 1969, 1970.
- (5) H. J. Heinz Company, The Heinz Handbook of Nutrition, Blakiston/McGraw-Hill Book Company, New York, N.Y., 1959.
- (6) Monroe, K. H., et al., Food Technology, Vol. 2, 1949, p. 292.
- (7) Feaster, J. F., "Foods of Plant Origin," p. 337, in Nutritional Evaluation of Food Processing, by R. S. Harris and H. von Loesecke (eds.), John Wiley and Sons, Inc., New York, N.Y., 1960.
- (8) Guerrant, N. B., et al., Industrial Engineering Chemistry, Vol. 40, 1948, p. 2258.

- (9) Moschette, D. S., et al., Industrial Engineering Chemistry, Vol. 39, 1947, p. 994.
- (10) Schweigert, B. S., and Lushbough, C. H., "Effects of Processing on Meat Products," pp. 269 and 380, in Nutritional Evaluation of Food Processing, by R. S. Harris and H. von Loesecke (eds.), John Wiley and Sons, Inc., New York, N.Y., 1960.
- (11) Wanner, R. L., "Effects of Commercial Processing of Milk and Milk Products on Nutrient Content," pp. 181-188, in Nutritional Evaluation of Food Processing, by R. S. Harris and H. von Loesecke (eds.), John Wiley and Sons, Inc., New York, N.Y., 1960.
- (12) Morgan, A. F., "Losses in Nutrients During Home Preparation of Foods," Chap. 11, in Nutritional Evaluation of Food Processing, by R. S. Harris and H. von Loesecke (eds.), John Wiley and Sons, Inc., New York, N.Y., 1960.
- (13) Chain Store Age, 1969 Supermarket Sales Manual, Lebhar-Friedman, Inc., New York, N.Y., July 1969.

Chapter 5

PRODUCE

I. INTRODUCTORY REMARKS

This group of food products, which accounted for 7.48 percent of total supermarket sales in 1968 (1), is unique when viewed by modern concepts of merchandising--principally, because much of it is not prepackaged before offered for sale. Another area of peculiarity is the inconsistency with which refrigeration is applied to these products. Some fruits and vegetables, especially those being shipped long distances, are refrigerated during transit, but not during display for sale. They are then refrigerated in the home. However, an exception to the practice in some retail outlets is the cooling of vegetables and some fruits with water sprays during display. Produce items from nearby farms, on the other hand, are usually not refrigerated during transportation to major markets, but are sometimes refrigerated prior to redistribution to local markets.

Some major items, which are mentioned later, are stored as a result of peak seasonal production under controlled atmosphere storage for later distribution as fresh produce.

II. SUMMARY OF RECOMMENDATIONS (see also section IX)

A. Open dating of unpackaged raw products in this group is not recommended; date of shelf display is recommended for all prepackaged products.

B. Adoption by the New Jersey Department of Health of the Coding Recommendations of the FDA Good Manufacturing Practices, Federal Register, April 26, 1969, for processed foods (i.e., washed and packaged produce). Disclosure of code meanings by food manufacturers to the New Jersey Department of Health on request by the latter.

C. In the case of prepackaged products, adoption of the open date of manufacture labeling for all outer cases/overwraps, etc. to assist in stock rotation.

D. Voluntary coding of all individual containers in such cases/overwraps by the food industry with codes of its own choosing (similar in intent to A. above). Such codes should indicate plant location, date of manufacture of final product in container, shift, production line, and any other aspects of products, at the manufacturer's discretion.

III. TYPE OF FOOD AND PRODUCT GROUPS

Produce, by product group and category

<u>Product group</u>	<u>Percentage of total sales</u>	<u>Product category</u>	<u>Percentage of category sales</u>	<u>Percentage of total sales</u>
Vegetables	5.04			
		Potatoes	20.9	1.85
		Tomatoes	7.8	.68
		Lettuce	6.4	.57
		Onions	4.4	.37
		Celery	2.7	.24
		Cucumbers	2.6	.23
		Corn	2.5	.22
		Carrots	1.7	.15
		Cabbage	1.6	.14
		Peppers	1.3	.12
		Mushrooms	.9	.08
		Radishes	.8	.07
		Beans	.4	.04
		Sweet potatoes and yams	.3	.03
		Spinach	.3	.03
		Cauliflower	.3	.03
		Peas	.2	.02
		Parsley	.1	.01
		Escarole	.1	.01
		Eggplant	.1	.01
		Broccoli	.1	.01
		Squash	.1	.01
		Other vegetables	1.3	.12
		Subtotal	56.9	5.04
Fruit	3.78			
		Bananas	7.9	.70
		Cantaloupes	5.7	.50
		Peaches	5.7	.50
		Apples	4.7	.42
		Plums	3.1	.25
		Grapes	2.6	.23

Source: Adapted, with permission, from data of Progressive Grocer (2). The figure of 8.82 percent of total sales does not correlate with the Chain Store Age (1) figure of 7.48 percent of total sales for produce which is not broken down into product groupings. The figures differ because the former data (2) were collected during the summer months when produce sales are higher than usual. The latter figure (1) is based on sales throughout the entire year.

<u>Product group</u>	<u>Percentage of total sales</u>	<u>Product category</u>	<u>Percentage of category sales</u>	<u>Percentage of total sales</u>
Fruit (Cont.)		Watermelons	2.4	.21
		Oranges	2.2	.20
		Nectarines	2.1	.19
		Strawberries	1.9	.16
		Lemons	1.3	.11
		Blueberries	.8	.07
		Apricots	.7	.06
		Cherries	.7	.06
		Grapefruit	.6	.05
		Melons	.3	.03
		Avocados	.1	.01
		Limes	.1	.01
		Pineapple	.1	.01
		Other fruit	<u>.1</u>	<u>.01</u>
			43.1	3.78
Total	8.82		100.0	8.82

IV. TYPE OF PROCESSING AND PRESERVATION

Fruits and vegetables tend to suffer less from attacks of microorganisms than from the continuation of their own life processes after harvesting (3). Consequently, low temperatures are used to retard such chemical reactions and the action of food enzymes after harvest, which also act to slow down or stop growth and activity of microorganisms. Naturally, the lower the temperature the slower the chemical reactions, enzyme action, and microbial growth. Consequently, there is a smaller loss of nutrients, and the activity of insects, rodents, and parasites is also retarded. The result of such curtailment is the preservation of the foods and the extension of shelf life.

The basic steps in fruit and vegetable processing and preservation involve harvesting at correct maturity, cleaning, and the reduction of temperatures within as short a time as possible. These steps are expanded as follows:

- (1) Raw products should be graded and cleaned to reduce their initial high bacterial load from adhering soil, dirt, etc.
- (2) Temperature reduction should be attained within 24 hours for fruits and vegetables (4).
- (3) Recommended relative humidity must be closely controlled; for fruits and vegetables, the level is at least 90 percent.
- (4) Temperature should be maintained at constant level of $\pm 2^{\circ}\text{F.}$ ($\pm 1^{\circ}\text{C.}$) since fluctuations in temperature can affect relative humidity and types of spoilage microorganisms (4).

- (5) Condensation should be avoided when products are taken from cold storage which introduces growth of microorganisms. Condensation occurs when the dew point of the surrounding air is higher than that of the product or of its packaging material, which in some cases may be of a barrier-type material that prevents condensation on the product. Moving foods from storage to transport vehicles of a similar temperature prevents this. Ideally, the distribution chain, including the consumer, should maintain storage temperatures until consumption. If condensation occurs, steps should be taken to dissipate it as soon as possible--perhaps by slow warmup in dry air. When temperature conditions cannot be closely maintained, the product should be covered until it warms up to above the dew point of its surroundings (4).

The conditions for optimal storage stability in the United States and the storage life of most of the refrigerated items delineated in section III above are given in table 6.

Table 6.--Storage requirements and properties of perishable products

Commodity	Storage temperature	Relative humidity	Approximate storage life <u>1/</u>
	-----°F.-----	---Percent---	
Apples	30-32	90	--
Apricots	31-32	90	1-2W
Avocados	45-55	85-90	4W
Bananas	--	85-95	--
Beans (green or snap)	45-50	85-90	8-10D
Blueberries	31-32	90-95	3-6W
Broccoli, sprouting	32	90-95	7-10D
Carrots:			
Prepackaged	32	80-90	3-4W
Topped	32	90-95	4-5M
Cauliflower	32	90-95	2-4W
Celery	32	90-95	2-4M
Cherries	31-32	90	10-14D
Corn, sweet	32	90-95	4-8D
Cucumbers	45-50	90-95	10-14D
Grapefruit	50	85-90	4-8W
Grapes:			
American type	31-32	85-90	3-8W
European type	30-31	90-95	3-6M

--Continued

1/ M = months; W = weeks; D = days.

Source: Adapted, with permission of the American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc., from ASHRAE Guide and Data Book (5), which is one of several such compilations available of this type of data.

Table 6.--Storage requirements and properties of perishable products--Continued

Commodity	Storage temperature	Relative humidity	Approximate storage life <u>1</u> /
	-----°F.-----	---Percent---	
Lettuce	32	95	2-3W
Limes	48-50	85-90	6-8W
Melons:			
Cantaloupe	32-40	85-90	5-15D
Honeydew and honey ball ..	45-50	85-90	3-4W
Watermelons	40-50	85-90	2-3W
Mushrooms	32	90	3-5D
Onions and onion sets	32	65-70	6-8M
Oranges	32-34	85-90	8-12W
Peaches and nectarines	31-32	90	2-4W
Pears, green	32	85-90	1-2W
Peppers, sweet	45-50	90-95	2-3W
Pineapples:			
Mature green	50-55	85-90	3-4W
Ripe	45	85-90	2-4W
Plums, including			
fresh prunes	31-32	90-95	3-4W
Potatoes:			
Early crop	50-55	85-90	--
Late crop	38-50	85-90	--
Radishes:			
Spring, bunched or			
prepackaged	32	90-95	3-4W
Winter	32	90-95	2-4M
Spinach	32	90-95	10-14D
Squash:			
Acorn	45-50	70-75	5-8W
Summer	32-40	85-95	4-5D
Winter	50-55	70-75	4-6M
Strawberries, fresh	31-32	90-95	5-7D
Sweet potatoes	55-60	85-90	4-6M
Tangerines	31-38	90-95	3-4W
Tomatoes:			
Mature green	57-60	85-90	2-4W
Firm ripe	45-50	85-90	2-7D

There are few widely applicable general low-temperature storage conditions. Fidler (6) points out that the results of storage conditions in one country cannot be applied to a different country, owing to various reactions to cold storage resulting from differences of variety, soil, and climate.

According to ASHRAE (5), temperatures of storage range from 30 to 60°F. Some fruits and vegetables are subject to low-temperature injury. Table 7 lists selected commodities and the type of injury caused by low-temperature storage.

Table 7.--Type of injury caused by low-temperature storage, by selected commodities

Commodity	Approximate lowest safe temperature (°F.)	Character of injury when stored between 32°F. and safe temperature
Apples, certain varieties	34-36	Internal browning, soggy breakdown
Avocados	45	Internal browning
Bananas, green or ripe	56	Dull color when ripened
Beans, snap	45-50	Pitting increasing on removal, russetting on removal
Cranberries	34	Low-temperature breakdown
Cucumbers	45	Pitting, water-soaked spots, decay
Eggplants	45	Pitting or browning, increasing on removal
Grapefruit	45	Scald, pitting, watery breakdown, internal browning
Lemons	55-58	Internal discoloration, pitting
Limes	45	Pitting
Mangoes	50	Internal discoloration
Melons:		
Cantaloupes, honey dew, casaba, crenshaw, and Persian	40-50	Pitting, surface decay
Watermelons	36	Pitting, objectionable flavor
Okra	40	Discoloration, watersoaked areas, pitting, decay
Olives, fresh	45	Internal browning
Oranges, California	35-37	Rind disorders
Papayas	45	Breakdown
Peppers, sweet	45	Pitting, discoloration near calyx
Pineapples	50*	Dull green when ripened
Potatoes, Chippewa and Sebago	40	Mahogany browning
Squash, winter	50-55	Decay
Sweet potatoes	55	Decay, pitting, internal discoloration
Tomatoes:		
Ripe	50	Breakdown
Mature green	55	Poor color when ripe; tendency to decay rapidly

Source: USDA Handbook No. 66 (7). *For full-ripe fruit, 45° is satisfactory.

The Consumer and Marketing Service of USDA has established grade standards for many vegetables and fruits which are for voluntary use. They may be used by the processor or required by the purchaser.

During the past few years, the practice of prepackaging vegetables and fruits has become increasingly common. Potatoes are frequently packed in paper bags or open mesh net bags. Tomatoes are often packed in rigid plastic trays with transparent overwraps. According to the United Fresh Fruit & Vegetable Association (8), most of the carrots reaching the retail market are now topped and packed in transparent bags.

In prepackaged produce, the control of relative humidity is equally important, together with temperature control during storage and transportation as in the case of unwrapped produce. The optimum range of relative humidity varies with different products and the sensitivity to relative humidity differs from item to item.^{1/}

Such prepackaging does not give rise to any undue aesthetic or health hazards; in fact, since all the products are washed and graded prior to prepackaging, the incidence of damaged products reaching the consumer is possibly reduced by such processing steps.

Generally, foods considered suitable for refrigeration are those which are to be used in a reasonable time after harvesting. However, by controlling the temperature, relative humidity, and/or the atmospheric environment of storage, they can be stored for relatively long periods of time. (See data in table 6 above.)

As a result of these practices, some commodities reach the consumer market after several months of storage. There is no way to determine which commodities have been freshly produced and which have been released from storage other than by having a knowledge of the approximate growing seasons. The following paragraphs discuss some fruits and vegetables delineated in section III above.

Potatoes, one of the most widely used vegetables, are often stored for several months. During this storage period, temperature control is critical. Storage of potatoes at 40°F. or below is likely to cause considerable amounts of the starch to be converted to sugar, resulting in unacceptably sweet tasting potatoes, unless this process is reversed by holding the potatoes at 70-80°F., until quality control tests show that the starch content has been restored. Early crop potatoes are an exception and are usually not stored because they are readily damaged. Late crop potatoes may be stored between 38° and 50°F., but with the possibility of undesirable sweetness developing. Storage at 50-60°F. yields potatoes with better texture and flavor, but at this temperature sprouting is likely to occur. If sprouting occurs, it may then be suppressed by lowering the temperature. Commercial sprout inhibitors are sometimes

^{1/} The optimum storage and handling conditions can be ascertained from the publications of ASHRAE (5), United Fresh Fruit & Vegetable Association (8), Refrigeration Research Foundation (9), USDA (7), and the International Institute for Refrigeration (4).

applied prior to storage to retard sprouting if potatoes are to be stored for a long time at higher temperatures.

Lettuce is usually chilled to about 33°F. by vacuum dehydrocooling. Vacuum dehydrocooling of produce results in the evaporation of limited amounts of moisture from the relatively large surface of leafy products and comparatively rapid cooling throughout the whole product. The operation may be carried out in the harvest field. This technique has been used to improve lettuce quality over what it formerly was when lettuce was chilled by slower methods. Vacuum cooling shortens the time required to reach 33°F. and also reduces costs. It does not depend on the slower cooling from the outside in, as is the case when cooling is done by means of contact ice or chilled air. While vacuum cooling is well suited for cooling lettuce, it can also be used for products such as celery.

Hydrocooling is another technique which rapidly reduces the temperature of such products as sweet corn, cauliflower, and carrots by the application of jets of cool water. This method may be accomplished by either flooding, spraying, or immersion (5). At least one equipment manufacturer makes a mobile hydrocooling unit which can be taken directly to the fields being harvested. The process minimizes flavor and nutritional losses.

Air cooling is also used but is being replaced in many instances by either vacuum dehydro- or hydrocooling techniques. Air cooling is accomplished by air circulating in refrigerated rooms, in refrigerated rail cars, or by continuous conveyors passing through wind tunnels (5).

Some vegetables such as asparagus are usually not stored for longer than 2 or 3 weeks, whereas crops such as potatoes are usually stored in peak growing seasons for sale during winter and spring months.

Storage life is governed by metabolic activity. Modifications of atmospheric composition in storage showed that higher than normal concentrations of carbon dioxide depressed respiration, germination, and ripening (10). This has led to the process of controlled atmosphere storage of products at lower temperatures in gases which arrest and interrupt metabolic ripening processes. The process has a distinct advantage. When conditions are changed back to normal, i.e., air plus oxygen versus carbon dioxide, the metabolic processes are able to continue, so that products can be picked prior to maturity, stored in controlled atmospheres, and released for sale at later dates with higher aesthetic appeal of texture and flavor than that which was previously possible just from low temperature storage. The controlled atmosphere storage of apples is now in current use to provide improved quality apples from producer to the marketplace.

Bananas are strictly tropical fruits which are harvested while green. With the exception of the Gros Michel variety, green bananas are held at about 56°F. to delay ripening (8). Below that temperature, peel injury results. Ripening is usually accomplished in 4-10 days by raising the temperature 58-64°F. Ethylene, a natural ripening agent, is now being used in external applications to ripen bananas. Following ripening, the bananas are best kept at 55-58°F. and 85 percent relative humidity until shipped to retail outlets.

According to ASHRAE (5), recommended storage temperatures for oranges range from 32 to 48°F., whereas storage temperatures recommended for grapefruit range from 50 to 60°F. According to Redstrom (11),

"If grapefruit and lemons are held for several weeks at temperatures lower than 50° to 55°F., pitting of the skin and discoloration may result. Bananas, both ripe and green, suffer chilling injury at temperatures below 56°F. These fruits and melons, avocados and pineapples are best stored at a cool room temperature. Keeping citrus fruits in the refrigerator as long as a week or chilling of any of these fruits to a desired serving temperature will not be harmful."

Oranges may be obtained fresh throughout most of the year. Florida grows more oranges than California; however, far less Florida oranges reach the fresh produce market than California oranges because a greater proportion of the former is used to make frozen orange concentrate (12). Although California oranges are available throughout most of the year, they reach their peak production in June, July, August, and September. Florida oranges reach their heavy production in November through April. Some oranges are also imported from Mexico and Israel. The Valencia variety constitutes about half the U.S. orange crop during most years. It is followed by other varieties including, among others, Washington navel, Hamlin, Porson Brown, Pineapple, and Temple.

Oranges are washed before being packed for shipment in cartons or boxes. A significant number of oranges are packed into consumer size packages before reaching the retail store. These containers are generally perforated film or mesh bags.

Oranges may be satisfactorily stored up to 8 weeks, but most oranges go directly to the fresh fruit market and are only stored for short periods incidental to transportation and distribution. Florida fruit store satisfactorily at 32°F. and 85-90 percent relative humidity, according to the United Fresh Fruit & Vegetable Association (8). California fruit are best stored above 40°F., because rind disorder may result from low-temperature storage. Actual storage conditions vary, depending on location of growing area. Usually, desert grown fruit are stored at 48-50°F.

Grapefruit are principally grown in Florida, Texas, Arizona, and California, and serve largely as an appetizer. The heaviest production of grapefruit from these combined sources is October through May. Grapefruit are often treated with fungicides to control stem-end rot and green and blue molds which can readily develop as postharvest decay on Florida fruit. This treatment often takes the form of "byphenyl" impregnated pads in packing cases. Short-term storage can be at 32°F., but for longer storage, temperatures of 45-55°F. are recommended.

Cantaloupes, while a small percentage of fruit produced, are an important complement to grapefruit as appetizer fruits, being marketed at that time of year when grapefruit are at their lowest production levels. They are produced in a number of States and are principally harvested May to September, the earlier crops coming from Texas, California, Florida, Georgia, South Carolina, and Arizona. Later cantaloupe harvests come from the more northerly States

across the United States, including southern New Jersey, which has a localized production of such fruits.

Cantaloupes are usually stored at 36-38°F. for no more than 1 week. They may be satisfactorily stored 1-2 weeks at 32°F., at 85-90 percent relative humidity.

V. QUALITY CHARACTERISTICS

Fresh fruits and vegetables are eaten mainly for aesthetic reasons and for the basic nourishment and nutritional requirements they provide. They are essential to the diet for the various vitamins and minerals they provide, particularly vitamins A and C. They are, however, generally judged by the consumer in retail outlets by their aesthetic properties, i.e., (1) appearance, including shape, color, lack of wilting, lack of bruises, and size; (2) texture, including firmness, maturity, dryness; and (3) flavor.

VI. PROCESSING AND STORAGE QUALITY LOSS FACTORS

Quality losses which may take place between harvesting and retail sale vary widely. Some of the obvious losses are wilting of outer leaves, bruises on fruit owing to improper handling, overripening because of late harvesting or old age, and improper temperature and humidity conditions of storage or transportation. None of these losses causes potential health hazards. Some result from chemical changes which affect color, flavor, and nutrient content. Nutrient changes may be rapid or slowly progressive. Examples of a few of these changes are provided in table 8.

The aesthetic qualities of fruits and vegetables change in varying degrees between harvest and consumption. This natural phenomenon usually limits their period of stability and usability as evidenced by changes in their appearance, i.e., browning and wilting, and textural changes of first ripening and then softening.

In view of the known losses of nutrients occurring in fruits and vegetables between harvesting and consumption, there may be greater losses of nutritional qualities in fresh fruits and vegetables if these are unrefrigerated than there are in the equivalent frozen products. The latter are generally frozen shortly after harvesting; once frozen, most nutritional deteriorative processes are arrested. There are, however, other deteriorative losses that occur in frozen food preparation which do not occur in fresh food handling. An example is trimming, cutting, and blanching which are applied to some fruits and vegetables before freezing. To ascertain the facts in these matters, a detailed literature study would be necessary to determine the loss rates at various temperatures and correlate these with losses in the various types of processing.

Table 8.--Losses in ascorbic acid in selected vegetables under various conditions of storage

Commodity	Storage conditions	Loss
		<u>Percent</u>
Asparagus	24 hr. at 66-78°F.	40
	24 hr. at 35°F.	3
	24 hr. at 70°F.	20
	1 wk. at 32°F.	50
	1 wk. at 70°F.	70
Asparagus tips	96 hr. at room temp.	80
Beans, green	24 hr. at room temp.	20
	96 hr. at room temp.	30
	24 hr. at 46-50°F.	10
	96 hr. at 46-50°F.	10-30
Broccoli	24 hr. at room temp.	50
	96 hr. at room temp.	80
	24 hr. at 46-50°F.	10-30
	96 hr. at 46-50°F.	25-40
Chard, Swiss	24 hr. at room temp.	35
	96 hr. at room temp.	85
	24 hr. at 46-50°F.	30
	96 hr. at 46-50°F.	70
Corn, unhusked	7 days at 34-40°F.	0
Lima beans, shelled ...	48 hr. at room temp.	67
	48 hr., refrigerated	16
Lima beans, in pod	48 hr. at room temp.	39
	48 hr., refrigerated	5
	96 hr. at room temp.	72
	96 hr., refrigerated	19
Spinach	24 hr. at room temp.	34-48
	192 hr. at room temp.	95
	72 hr. at 72-79°F.	50
	72 hr. at 34-37°F.	0
	48 hr. at room temp.	78
	48 hr. at 32°F.	Slight
	24 hr. at 41°F.	19
	72 hr. at 70-72°F.	50-90
	24 hr. at 70°F.	43
	48 hr. at 70°F.	47
	24 hr. at 66-78°F.	29

Source: Adapted from table compiled by H. von Loesecke in Nutritional Evaluation of Food Processing (13). Used with permission of coeditor, R. S. Harris, who owns the copyright.

The nutritional changes taking place in produce are so varied that only a brief representative cross-section can be given here from the following excerpt by Watt and Wu Leung (14). 2/

"Fresh vegetables, such as kale, spinach, turnip greens, chard, broccoli, and salad greens, need to be refrigerated as soon as possible. They keep their nutrients best near freezing and at high humidity.

"Leafy, dark-green vegetables and broccoli keep practically all of their ascorbic acid for several days if they are packed in crushed ice. They retain about half of it after 5 days in the refrigerator at 40° to 50°F. Although this represents a large proportional loss, deep-green leaves have such high initial values that they remain excellent sources of ascorbic acid and vitamin A even after this substantial loss. They could be expected to provide more vitamins C and A than freshly harvested snap beans and head lettuce--perhaps more even than tomatoes.

"Cabbage is a more stable source of ascorbic acid than most leafy vegetables. Kept in cold storage under 40°F., it retains three-fourths or more of its vitamin C as long as 2 months.

"Cabbage should not be allowed to dry out. If it is to be held at home for a few days, it should be wrapped or put in a special compartment where the humidity is high. Cabbage holds its vitamin C well for a few days even at room temperature (usually considered to be 60 to 80°F.).

"Among other vegetables that also retain their ascorbic acid well at room temperature and do not require high humidity are a number that stem from tropical plants, like peppers (a rich source of vitamin C), snap beans, lima beans, and tomatoes.

"The ascorbic acid in tomatoes vine ripened out of doors in summer sunlight is double that in those grown in greenhouses in winter. Green tomatoes just beginning to turn color also are a good source if they have been exposed to full sun; they may have more vitamin C than red tomatoes from the same plant that ripened under foliage.

"Tomatoes picked before they turn red do not reach their best in appearance and nutritive value either on a hot window sill or in the refrigerator. The bright-red color does not develop when the temperature goes above 85°F. for very long. A temperature between 60° and 75°F. is desirable. Tomatoes become soft, watery, and easily subject to decay when they are ripened in the refrigerator.

"Firm, ripe tomatoes can be held at room temperature several days, probably a week, without loss of ascorbic acid. They lose their value rapidly as soon as they become overripe.

2/ More information is contained in an article on Conserving Nutrients in Handling, Storing, and Prepackaging Fresh Fruits and Vegetables, published by the United Fresh Fruit & Vegetable Association. This publication is provided at the end of this chapter with permission of the Association.

"Fresh strawberries are such a good source of ascorbic acid that a handful direct from the patch would supply a man his entire day's need of vitamin C.

"Berries generally are highly perishable and lose much of their ascorbic acid quickly if capped or stemmed or if their tissue becomes bruised. Berries to be held a few days must be kept cold, dry, and whole to retain their maximum values.

"Oranges, grapefruit, lemons, limes, and tangerines have a high initial content of vitamin C, and it is well retained under many conditions. Citrus fruits when whole keep well several days without refrigeration.

"Orange juice, whether it is freshly squeezed, or canned, or reconstituted from frozen concentrate or dehydrated crystals, retains most of its ascorbic acid for several days in the refrigerator. A few hours outside the refrigerator will not result in serious loss. A change in flavor would occur before much of the vitamin value is lost.

"For practical purposes, foods usually are kept covered, but a lid on the orange juice container makes no important difference in the retention of vitamin C. There is no harm in keeping canned juice in the can until it is used up.

"There is a loss of edible material--and therefore nutritive value--when oranges are squeezed and the juice is strained. The edible yield of the orange as strained juice is only about two-thirds to three-fourths that of the orange eaten by sections. Babies need the juice strained, but others get much more value from the orange used in other ways.

"Carrots, sweetpotatoes, potatoes, and other roots and tubers retain their most important nutrients reasonably well outside the refrigerator if kept cool and moist enough to prevent withering. They spoil quickly when they are in direct contact with water. Condensation moisture should not be allowed to drop on them. They may be kept in a root cellar; a cool, well-ventilated basement in summer; or an unheated pantry or garage. Information on building simple storage facilities for maintaining good eating qualities of specific fruits and vegetables is available in publications that can be had by addressing the Office of Information, the United States Department of Agriculture.

"Carrots and sweetpotatoes are unique among these roots and tubers for their high content of carotene.

"Carotene, often referred to as pro-vitamin A, is a substance in plant foods that the body can convert to vitamin A. Hence, we speak of vitamin A value. This term, 'vitamin A value,' may refer to vitamin A itself or to its precursors, among them beta carotene.

"Carrots have carotene as their most important nutrient. Removing the tops does not affect their vitamin A value.

"Sweetpotatoes of the deep orange-colored varieties are important sources of carotene. The content is high initially; it increases during the usual period of storage before sweetpotatoes reach the retail market. The carotene content drops gradually after 6 months. Few sweetpotatoes are stored that long.

"Potatoes, parsnips, turnips, and sweetpotatoes are not rich in ascorbic acid but nonetheless may be vital sources of it.

"Freshly dug potatoes are highest in ascorbic acid. Immature potatoes have more than those left to mature. The loss of ascorbic acid is progressive throughout the storage period, but is most rapid during the early weeks. About half is left after 3 months of storage. Potatoes still retain about one-third of their original content after 6 months.

"Potatoes develop an undesirable sweet flavor when held a long time at a few degrees above freezing. Such chilling does not impair their nutrient content, and their bland flavor returns if they are brought to room temperature or just below for a few days.

"Potatoes exposed to strong light may develop green spots. Since there is some question of toxicity associated with the pigmented area, it is advisable to discard the green-colored parts.

"Ascorbic acid behavior in sweetpotatoes follows the pattern of greater losses in the early months of storage and more gradual loss later. At the end of 3 months in storage, when about 75 percent of the crop has reached the consumer, 30 to 50 percent of the original content of ascorbic acid is lost. Another 10 percent is lost by the end of 6 months."

VII. PRESENT PRACTICES OF CODE DATING/PUBLIC DATING

A. Voluntary Food Industry Code Dating and Monitoring

The survey team failed to contact any major producers or packers in this industry. There appears to be virtually little or no labeling or dating of any fresh produce in its readily available forms, although some bulk packs are coded. Potatoes and carrots are two of the main vegetables which are packaged but not dated. Potatoes are often prepackaged in paper bags. One large super-market chain (#30FIS), which sells potatoes in sealed, ventilated paper bags, designates its geographical source, e.g., Long Island, but does not give any other information or details about harvesting or storage.

B. Legal or Required Dating

1. Federal--There are no Federal requirements for public dating. The FDA regulations contained in the Federal Register, April 26, 1969, Good Manufacturing Practices, indicate that FDA would like code dating for interstate and intrastate commerce shipments.

2. State and (3) Municipal--No dating requirements were located. Many States, however, require that products which are put into cold storage

(Cold Storage Acts) have date-in, date-out labeling. (Note: Cold storage temperature ranges were not defined in these acts, so whether refrigerated (less than 40°F.) or frozen (0°F.) temperatures are involved is not clear.)

C. How Dating Influences Quality Maintenance: Advantages and Disadvantages of Dating

The consumer is perhaps better able to judge products in this major department by visual and tactile means than in any other area. Dating would be of little significance, if any, particularly if date of manufacture were to be applied in this instance, which might even lend itself to consumer confusion. The difficulty of labeling individual products in unpackaged forms, e.g., grapes or locally grown watermelons, has only to be visualized to be comprehended.

VIII. FOOD PRODUCT ITEM LIST

The best conditions for handling produce and their resultant shelf lives are listed in the aforementioned references of ASHRAE (5), United Fresh Fruit & Vegetable Association (8), Refrigeration Research Foundation (9), USDA Handbook No. 66 (7), and the International Institute of Refrigeration (4).

IX. RECOMMENDATIONS ON BEST MEANS OF FOOD QUALITY MAINTENANCE

In a paper on "Produce Packaging--Past, Present, and Future," presented at the 19th Annual Convention of the Produce Packaging and Marketing Association, December 15, 1969, Donald R. Stokes reported that ". . . 46% of the 55 billion pounds of fresh fruit and vegetables marketed annually is now prepackaged before delivery to retail stores. . . ." In the unpackaged state, these food items generally monitor themselves by their appearance because spoilage or imperfections can be readily seen by both merchant and consumer, and consumers notably handle and examine produce prior to purchase. However, this is not the case for prepackaged items, which should be coded on each unit package.

Open dating or code dating of bagged potatoes would not serve a useful purpose because the potatoes may be either freshly harvested or may be storage potatoes. If freshly harvested, they may be "early crop" or "late crop" potatoes; they may be one of a number of varieties, from a variety of growing areas with somewhat varying characteristics. If they are "storage" potatoes, the length of time of storage, the conditions of storage, and the seasonal characteristics will affect their quality and durability, which dating would not indicate.

The application of date of shelf display by retailers is recommended on all packages of fruits and vegetables.

X. REFERENCES

- (1) Chain Store Age, 1969 Supermarket Sales Manual, Lebhar-Friedman, Inc., New York, N.Y., July 1969.

- (2) Progressive Grocer, Consumer Dynamics in the Supermarket, New York, N.Y., 1966.
- (3) Bate-Smith, E. C., "Progress in the Chilling and Freezing of Foods," Journal of Food Technology (United Kingdom), Vol. 2, 1967, p. 191.
- (4) Institut International du Froid, Conditions recommandees pour l'entreposage frigorifique des produits perissables (International Institute of Refrigeration, Recommended conditions for cold storage of perishable produce), 2nd ed., 1967.
- (5) American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc., ASHRAE Guide and Data Book, Applications for 1968, New York, N.Y.
- (6) Fidler, J. C., Refrigerated Storage of Fruits and Vegetables in the United Kingdom, the British Commonwealth, the U.S.A. and South Africa, Congresso Internazionale sulla conservazione e distribuzione dei prodotti ortofrutticoli, Bologna, 91, 1963.
- (7) U.S. Department of Agriculture, The Commercial Storage of Fruits, Vegetables, and Florist and Nursery Stocks, Handbook No. 66, Washington, D.C., 1954.
- (8) United Fresh Fruit & Vegetable Association, Fruit and Vegetable Facts and Pointers, Washington, D.C.
- (9) Refrigeration Research Foundation, Washington, D.C.
- (10) Kidd, F., and West, C., Food Investigation Special Report, 1923-35, Department of Scientific and Industrial Research, England. (Now out of print.)
- (11) Redstrom, R., "Storing Perishables at Home," Food. The Yearbook of Agriculture, 1959, U.S. Department of Agriculture, Washington, D.C., 1959, pp. 477-482.
- (12) The Almanac of the Canning, Freezing, Preserving Industries, 53rd ed., E. E. Judge & Sons, Westminster, Md., 1969.
- (13) von Loesecke, H., in Nutritional Evaluation of Food Processing, by R. S. Harris and H. von Loesecke (eds.), John Wiley and Sons, Inc., New York, N.Y., 1960.
- (14) Watt, B. K., and Wu Leung, Woot-Tsuen, "Conserving Nutritive Values," Food. The Yearbook of Agriculture, 1959, U.S. Department of Agriculture, Washington, D.C., 1959, pp. 483-494.

CONSERVING NUTRIENTS IN HANDLING, STORING AND PREPARING FRESH FRUITS AND VEGETABLES



(This report is in two parts: I, General Principles; and II, Information on Individual Commodities or Groups of Commodities.)

I. General Principles

The nutritive value of fruits and vegetables is not measured by their cost or the quantity brought home but on how much of the food purchased is actually eaten and the nutrients this portion contains. Nutrients begin to be lost as soon as fruits and vegetables are harvested, and whether or not they are processed, although in exceptional instances, there is an actual increase in certain nutrients in the fresh, still living, unit. There are ways of keeping losses to a minimum and especially of insuring the preservation of a high percentage of the ascorbic acid (vitamin C) and carotene (pro-vitamin A) of which fruits and vegetables are the principal dietary sources. They supply more than 92% of the vitamin C and 59% of vitamin A, as well as many other nutrients including iron and folic acid. This report deals only with conserving nutrients in the fresh products.

Enemies of the Nutrients

The enemies of fruit and vegetable nutrients—generally speaking—are time (because if there are losses, they usually are progressive with time), heat, enzyme activity, invading micro-organisms, direct contact with water, mechanical or chemical injury of the cellular structure, oxidation, light in some instances, excessively dry environment and waste.

Conversely, factors favorable to conserving nutrients are rapid harvesting, cooling, packing, transporting and marketing; gentle handling; early consumption of purchased produce; use of properly controlled temperatures and humidity until the food is served; avoidance of soaking in water; rapid cooking; use of liquids in

which vegetables are cooked; avoidance of light while cooking and also in storing certain vegetables; conservatism in paring and coring; conservatism in chopping and mashing; and preparing amounts fairly close to what will be consumed so there are not large quantities of leftovers.

Freshness and Nutrients Are Companions

A study of the technical literature made for the United Fresh Fruit & Vegetable Association by the medical research firm of L. G. Maison & Co., Chicago, showed that “a close correlation usually holds between good retention of vitamin values of fresh fruits and vegetables and good retention of their quality values (such as color, flavor, aroma and texture). Conditions that make for retention of freshness also make for retention of the vitamins.”

It was also concluded that “the deteriorative changes in the fresh fruits and vegetables improperly cared for in the home or in dining establishments may be more serious than the sum total of the deteriorative changes during the entire course of the products from the field to the retail market.”

It is evident, therefore, that buying fresh, high quality fruits and vegetables means buying more nutrients per dollar than when poor quality produce is purchased. Buying for quality also conserves nutrients by eliminating or reducing the number of units discarded; and permits use of the product with a minimum of trimming or paring.

Aroused Appetites Avoid Waste

Serving these foods in attractive forms that stimulate the family appetite also saves nutrients by encouraging consumption of what might otherwise be rejected. No matter how many milligrams of vitamins and minerals are in a vegetable, they are useless if the food is so poorly cooked or otherwise prepared that it is left on the plate.

United Fresh Fruit & Vegetable Association, 777 14th St. N.W., Washington 5, D.C.

Ascorbic Acid Is Unstable

Ascorbic acid, the major nutrient in fruits and vegetables, is more subject to loss than any other vitamin or mineral. Therefore, if this vitamin is guarded, it is quite likely other nutrients will be preserved also. While the compound is fairly stable in acid solution, it is readily destroyed under non-acid conditions, especially when heat is applied, which speeds up oxidation. (It should be noted that oxidation does not necessarily require a supply of oxygen, as from air.) To a large extent the vitamin can be conserved by refrigeration under humid conditions; cooking for as short a time as possible or using without cooking; utilizing the cooking water or other liquids in which some of the ascorbic acid would be dissolved; avoiding keeping food hot (as on a steam table) for long periods; avoiding long exposure to air especially when the food has been chopped or mashed, thereby greatly increasing the surface reached by air; and using the produce within a reasonable time. Ascorbic acid is soluble in water as are also the B vitamins.

Vitamin A Oxidized

Vitamin A, on the other hand, is not soluble in water, nor is carotene, the vitamin A precursor, the compound found in fruits and vegetables. Heat, of itself, does not destroy vitamin A but heat and air cause rapid oxidation and destruction. For example, aeration of heated cod liver oil causes complete loss of vitamin A activity. The same safeguards that apply to ascorbic acid apply in general to vitamin A except those that apply to solubility in water.

The minerals are not destroyed by heat and age but though present in their original quantities in an old, withered fruit or vegetable, they are not of value to the purchaser since the item will be discarded. Minerals

are water soluble and can be leached out in soaking or cooking. Consequently, an excessive amount of cooking water should not be used; and the cooking liquid should be consumed if palatable.

The Three R's

The three R's of cooking to preserve nutrients, as given by Dr. Bernice K. Watt and associates of U.S. Department of Agriculture are: Reduce the amount of water used; reduce the length of the cooking period; and reduce the amount of surface area exposed.

A Word About Trimming

Trimming of vegetables may be necessary to remove damaged leaves or inedible material, but should be held to a minimum. As a general principle, outer leaves, if good should be used, because they generally are dark green and contain more nutrients than inner leaves. Fibrous parts of leaves such as stems and ribs generally are not only less palatable but have less nutrients than the leaf blade. It is reasonable, therefore, to discard these parts if desired. The leaf blades of collard greens, for instance, have 30 times as much vitamin A as an equal weight of the midrib.

Temperature Control

All fresh fruits and vegetables should move to market under temperature control, suited to the particular requirements of each, and most of them are so transported. Conservation of nutrients starts at shipping point when field heat is quickly removed, units are washed or otherwise cleaned, vegetables are trimmed and all are packed and either stored at suitable temperature and humidity or loaded for rapid movement to market. Proper refrigeration is so important that fruits and vegetables shipped long distances under proper

MAINTAINING THE FRESH QUALITY IN PRODUCE IN WHOLESALE WAREHOUSES

Fresh Fruits			Fresh Vegetables			
Store at 32° F. and 90% Relative Humidity						
Apples	Figs		Artichokes	Cauliflower	Horseradish	Radishes
Apricots	Grapes		Asparagus	Celeriac	Kohlrabi	Rhubarb
Blackberries	Nectarines	Pomegranates	Beans, Lima	Celery	Leeks, green	Rutabagas
Cherries	Oranges	Prunes	Beets	Corn, Sweet	Lettuce	Spinach
Coconuts	Peaches	Quinces	Broccoli	Endive	Mushrooms	Salsify
Cranberries	Pears	Raspberries	Brussels Sprouts	Escarole	Onions, green	Squash
Dates	Persimmons	Strawberries	Cabbage	Garlic, dry	Parsnips	(yellow summer)
Dewberries	Plums	Tangerines	Carrots	Greens (general)	Peas, green	Turnips
Store at 50° F. and 80-85% Relative Humidity						
Avocados	Limes	Olives	Beans, green	Okra	Potatoes	Sweet potatoes
Grapefruit	Mangoes	Papayas	Cucumbers	Onions, dry	Pumpkins	Tomatoes (ripe)
Lemons	Melons	Pineapples	Eggplants	Peppers, sweet	Squash (hard shell)	
Commodities Requiring Special Conditions						
Bananas for ripening: 58° to 68° F., 90 to 95% relative humidity.			Green tomatoes, for ripening: 55° to 70° F., 85 to 90% relative humidity.			
Bananas, ripe (for holding): 55° to 60° F., 75 to 90% relative humidity.			Pears, for ripening: 60° to 65° F., 85 to 95% relative humidity.			

temperature conditions are likely to be in better condition and be more nutritious than local commodities sometimes marketed without pre-cooling and subsequent refrigeration.

The table (opposite) provides a broad, general guide on desirable temperature and humidity for specific fruits and vegetables. Since few institutions have enough storage boxes and refrigeration equipment for maintaining a variety of temperatures, all the fruits and vegetables have been split into two groups, the 32° group and the 50° group. There is also a list of commodities requiring special conditions. This data is from a paper "Maintaining the Fresh Quality In Produce in Wholesale Warehouses" by Bogardus and Lutz of USDA in Agricultural Marketing Dec. 1961.

Proper Ripening Is Important

Most non-citrus fruits and most melons may be ripened to eating stage at room temperature, considered to be 65-80° F., then should be refrigerated. Citrus fruits, however, are ripe as received, and can be refrigerated at once. The same is true of grapes. Holding an unripe fruit or melon at low temperature delays ripening. Obviously, if a melon or other fruit is served before it is ready for eating, it will not be liked and the fruit will not be consumed.

In the case of vegetables (other than tomatoes) ripening is not a factor. Keeping vegetables in covered containers or film bags helps to prevent evaporation and withering.

II. Data By Commodities

Following is nutrient retention data on various commodities, based on USDA and private studies in our files. Space does not permit listing data on all fruits and vegetables.

FRUITS (general) There has been little or no evidence that fruits lose carotene (pro-vitamin A) in the ordinary processes of handling and marketing where temperature and humidity are controlled and light excluded. Fruits largely retained their ascorbic acid content during 7 to 10 weeks of storage and in some cases much longer.

VEGETABLES (general) Cooked vegetables show losses of ascorbic acid that progress with the length of time that they are kept. They have about 75% as much ascorbic acid after one day in the refrigerator as when freshly cooked. They have about 66% as much after two days. Reheating takes another toll of ascorbic acid, so that cooked vegetables reheated after 2 or 3 days in the refrigerator can be counted on for only 33% to 50% as much ascorbic acid as when freshly prepared.

Green vegetables contain an enzyme which oxidizes the vitamin, but the enzyme only comes into contact with it when the leaves wilt or are crushed.

The vitamin will be oxidized, however, even in the absence of the enzyme, when conditions are alkaline or when traces of copper are present. Being water-soluble, vitamin C rapidly diffuses into the cooking water. Vitamin C is best preserved if the vegetable is not allowed to wilt before cooking. It should be cut sufficiently to allow it to be cooked quickly, but not chopped up so fine that the enzyme has easy access to the vitamin. To avoid alkalinity and consequent destruction of vitamin C, soda should not be used.

APPLES stored for 6 months at 32° F. showed virtually no loss of vitamin C. Storage for 3 months at 45° resulted in loss of about 17% of the vitamin C content, and in 6 months resulted in 25% loss. By contrast, apples stored in a cellar until spring retained only half as much ascorbic acid as apples stored under refrigeration.

ASPARAGUS refrigerated at ice temperature lost less than 20% of its original ascorbic acid in 5 days, whereas when cut and kept in a warm kitchen or in a store without refrigeration, it may lose 50% of its original vitamin C the first day; and by the second day have lost almost 80%.

BANANAS lost some ascorbic acid (sometimes 25%) during ripening as compared with the content of the fully green fruit, but when fully ripe the ascorbic acid remained constant until complete browning of the peel.

BEANS Both snap beans and shelled lima beans retained 90% or more of their original ascorbic acid when refrigerated for a week.

BLUEBERRIES lost 7% of their ascorbic acid in 2 days at 41° F. and 14% in four days.

BROCCOLI cooked quickly in a small amount of water loses only half as much vitamin C as when cooked in excess water. Broccoli retains ascorbic acid well under refrigeration.

CABBAGE is a stable source of ascorbic acid. In cold storage, the whole heads retain 75% or more of their vitamin C as long as six months. It should not be allowed to dry out. The outer dark green leaves are the most nutritious, being high in vitamins, so trimming should be conservative. Cabbage cooked quickly in about a third as much water as cabbage retains nearly 90% of the vitamin C it had when cooking starts, but when cooked in four times as much water as cabbage, it retains less than half of this vitamin.

CANTALOUPEs retained almost all their ascorbic acid for seven days in a refrigerator but lost 50% at room temperature. (However, ripen at room temperature.)

CARROTS generally increase in carotene content during storage. There is large loss of ascorbic acid during long storage, but carrots are not important for this vitamin. Carrots showed no marked loss of thiamine even in seven months storage. Removing the tops does not affect the vitamin value of this vegetable.

CITRUS fruits have a high initial content of vitamin C and it is well retained under many conditions. These fruits, when whole, keep well several days without refrigeration. The edible yield of the orange as strained juice is only about 66% to 75% as much as that of the orange eaten by sections. Since citrus fruits are rarely cooked, almost the full amount of the vitamin in the fruits is available, if eaten out of hand.

CORN stored at room temperature lost 45% of its total sugar content in the first 24 hours and an additional 4% in the succeeding 24 hours; but ears stored at 32° were still sweet and in good marketable condition after 10 days. Refrigerated corn lost little or none of its ascorbic acid after 7 days but corn at room temperature lost half its vitamin C after 4 days and in any event was no longer edible.

GREENS of all kinds have a high content of vitamin C and vitamin A. To keep it, they need to be refrigerated near 32°. However, the ordinary household refrigerator may be around 40° in the general food compartment. Tests show that greens refrigerated at 40 to 50° F. for 5 days lost about half their ascorbic acid. The thin part of the leaf may contain 20 times as much vitamin A, many times more vitamin C and 2 to 4 times more iron than the midribs, which are more fibrous and consequently less edible.

LETTUCE The dark green outside leaves have as much as 30 times more vitamin A than the inner bleached leaves, yet the darker leaves may make up only 10% of the weight of a head. So discard only discolored and damaged outer leaves. Lettuce loses ascorbic acid rapidly at room temperature but refrigeration favors retention of the vitamin.

ONIONS stored at not over 55° F. lost no appreciable amount of either ascorbic acid or thiamine in 6 months.

PEARS retain ascorbic acid well. When stored in closed containers near freezing they still had half their original ascorbic acid after 7 months.

PEPPERS retain ascorbic acid well under refrigeration. They may lose only around 10% in a week.

POTATOES retain their most important nutrients quite well outside the refrigerator if kept fairly cool, and inclosed so as to prevent withering. Freshly dug potatoes are highest in ascorbic acid, and immature potatoes have more than those more mature. The loss

of ascorbic acid is progressive throughout the storage period, but is most rapid during the early weeks. About half is left after 3 months storage. Potatoes still retain about a third of their original vitamin C after 6 months storage. Chilling potatoes below 40° F. does not impair their nutrient content but causes them to develop an undesirable sweetness. For vitamin C value, potatoes should be freshly cooked. Potatoes baked, broiled or pressure cooked and then stored in a refrigerator for 24 hours contained only about a third of the vitamin C in the freshly baked product.

STRAWBERRIES, an excellent source of ascorbic acid, lose much of it if capped or stemmed, or if their tissue becomes bruised. They should be kept cold, dry and whole to retain maximum nutritive value.

SWEETPOTATOES retain their most important nutrients reasonably well out of the refrigerator if withering is prevented. The carotene content of sweetpotatoes is initially high and increases during the usual period of storage. The carotene content drops gradually after 6 months storage, but few sweetpotatoes are kept that long. Ascorbic acid is lost more rapidly in early months of storage and more slowly later. At the end of 3 months in storage, when about half of the crop has reached the consumer, 50 to 70% of the ascorbic acid remains. By the end of 6 months, 40 to 60% remains.

TOMATOES picked before they turn red develop highest nutritive value at a temperature between 60 and 75° F. which means they should not be refrigerated until all red. Neither should they be exposed to high temperatures, such as 85°. Tomatoes grown outdoors have about twice as much vitamin C as tomatoes grown in greenhouses in winter. In fact green tomatoes just beginning to turn color, if they have been exposed to full sun, may have more vitamin C than red tomatoes ripened with less sunlight. Firm-ripe tomatoes can be held at room temperature for several days, probably a week, without loss of ascorbic acid. They lose vitamin C value rapidly as soon as they become over-ripe. So when ripe, refrigerate. Green fruit has been shown to increase in ascorbic acid as it ripens. Cooking tomatoes causes significant loss of ascorbic acid, and the longer they are cooked, the greater the loss.

REFERENCES Conserving Nutritive Values, Watt and Wu Leung, Food, Yearbook of Agriculture, 1959, p. 483-94; The Culinary Aspects of Nutrition, Yudkin, Practitioner, London, July 1955, p. 51-55; Conserving Food Values, Watt, Journal of American Dietetic Assoc., Feb. 1950, p. 106-10; Improving the Vitamin Content in Large-Scale Catering, Strohecker and others, Journal For Food Research and Investigation (German), 1960, 112; 1-10; collection of reports on nutrient retention tests in our files; Maintaining The Fresh Quality in Produce in Wholesale Warehouses, Bogardus and Lutz, Agricultural Marketing, Dec. 1961, p. 8-9.

R. A. SEELIG

FROZEN FOODS

I. INTRODUCTORY REMARKS

The commercial freezing of foods as individual retail packages has been practiced since the mid-1920's. Home freezing of ice cream and other foods predates this. Freezing is primarily a process for protective preservation, not a type of food. The protective mechanism of freezing depends on maintenance of food at low temperatures, 0°F. or lower, in the interval from production to consumption. Secondly, it is utilized for the preservation of processed gourmet-convenience products. In this case, the food manufacturers prepare and freeze food items which in the home would otherwise require culinary expertise or time-consuming preparation. Food manufacturers perform such operations in their plants and present the convenience product in a ready-to-heat manner for home and institutional consumers.

Chain Store Age (1) includes frozen foods in its major department classification of grocery perishables for convenience. If frozen foods are prepared and maintained with good sanitary standards, and kept below 0°F., they can be considered extremely stable food products, many of which have a shelf life of several years. However, if mishandled, they can deteriorate as perishable items within several hours. Consequently, this survey treats frozen foods separately.

The major quality features of frozen food, from promotional and consumer viewpoints, reside in their aesthetic appeal. These are, fortunately, the first apparent quality loss areas and serve as natural warning factors. Flavor and color are qualities most sensitive to gross temperature fluctuations. Nutritional quality losses occur, if at all, after initial processing losses at a much later phase in the chain of quality loss events.

The products considered under the title of frozen foods, while coming under the general heading of food at lower than room temperatures, differ from "chilled" (50°F.), "cold" (40°F.) and "refrigerated" (32°F.) foods by being kept constantly at 0°F. or lower, and having substantially all their water bound in the form of ice, i.e., "foods that are congealed by the removal of heat."1/

The effects of freezing are similar to, but not identical with, those of other lower temperature storage. The preservative benefits of freezing are

1/ In a personal communication to the team, Dr. R. Olson, Agricultural Research Service, USDA, maintains that the convention of regarding 0°F. as a standard for legislation is inapplicable to all frozen foods--some may even tolerate higher temperatures. The zero temperature is best viewed as an ideal. Evidence of 0°F. at a particular point does not assure quality, if the food packed were of original inferior quality, or had had excursions to radically higher temperatures, even defrosting.

generally greater than those of refrigeration owing to the lower temperatures employed, which slow down chemical changes and also prevent growth of food poisoning organisms. Freezing preserves food by:

- (1) Retarding or arresting enzyme activity
- (2) Retarding chemical activity (such as oxidation of fats)
- (3) Arresting growth of microorganisms, both harmful and beneficial (fig. 5)
- (4) Preserving nutritional values by reduction of chemical reaction rate
- (5) Controlling rodents, insects, and parasites because of their inability to live at low temperatures.

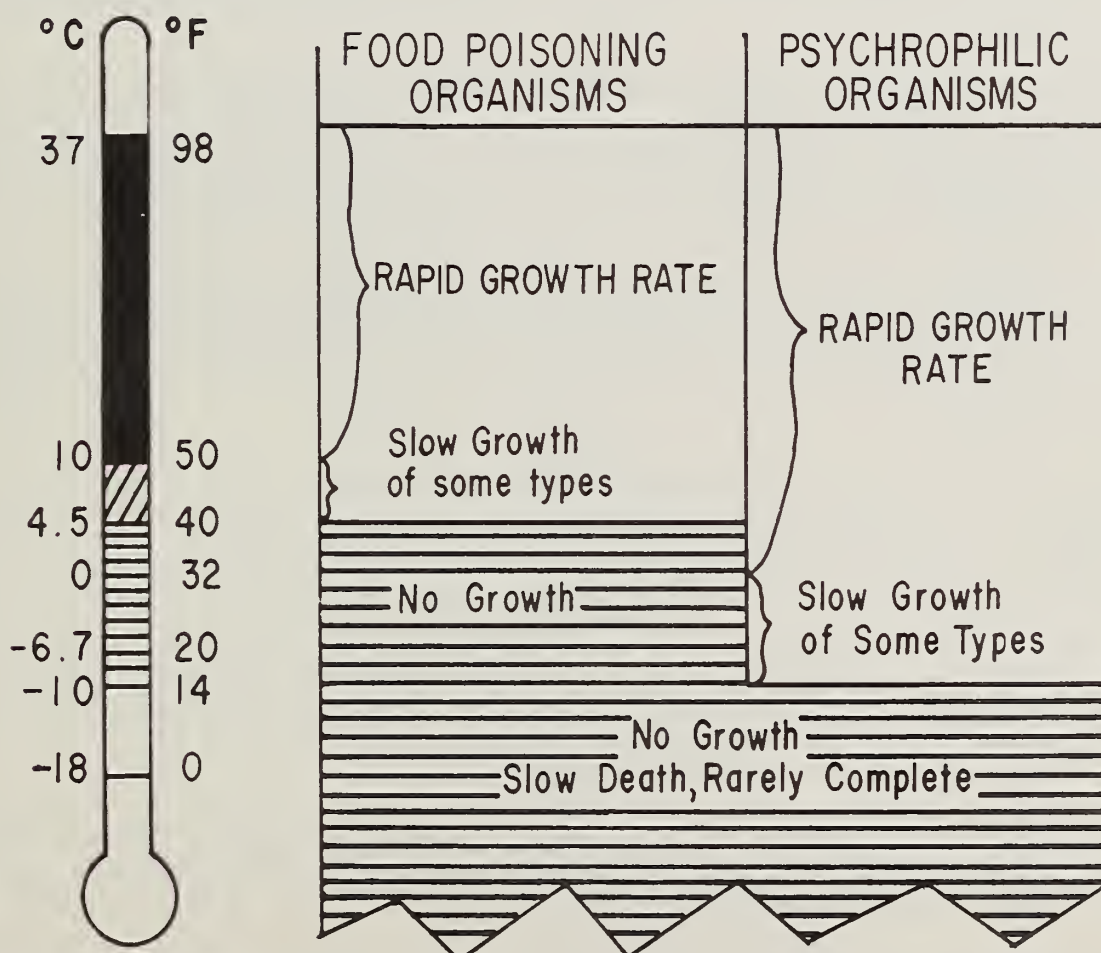


Figure 5.--Relationship of temperature and growth of microorganisms

Source: Elliott and Michener (43).

II. SUMMARY OF RECOMMENDATIONS

- A. Adoption by the New Jersey Department of Health is recommended of the concept of the United Kingdom's Three-Star System for frozen foods through the use of placards in retail outlets designed to illustrate the types of home freezers in common usage, their temperature of operation, and appropriate storage times corresponding to such temperatures as suggested by the U.K. System. Home-storage times after purchase for all foods, according to the U.K. System, are: 1 week at -6°C . (21°F .), 1 month at -12°C . (10°F .), and 3 months at -18°C . (0°F .). Ice cream is the sole exception, the approximate temperature and times being 21°F , 1 day; 10°F , 1 week; 0°F , 1 month.
- B. The use of open public expiration dating on frozen food packages by the manufacturer is not to be considered or permitted under any circumstances, unless it makes provisions for differences in consumer home freezer storage temperatures.
- C. Adoption is recommended of the AFDOUS Code by State and local departments of health agencies.
- D. Adoption and enforcement by all local New Jersey Boards of Health of the Ordinance Retail Food Establishment Code of New Jersey, 1965 (3), which provides for a maximum temperature of 0°F . in storage and transportation of frozen foods, is recommended as a statewide requirement.
- E. Implementation and surveillance of recommended practices for frozen food of AFDOUS (4), NAFFP (5), and ASHRAE (6) would be highly constructive quality retention measures for manufacturers, distributors, warehousemen, and retailers.
- F. Code dating by food manufacturers of all individual frozen food consumer unit packages (a modification of FDA's Good Manufacturing Practices, Federal Register, April 26, 1969), with date of final packaging, i.e., date of fill of final item, is proposed. Date of manufacture is considered equivalent to date of final packaging in this case. Coding of any other aspects of products may be at the manufacturer's discretion. Disclosure of code meanings would be required by food manufacturers to the New Jersey Department of Health on request by the latter.
- G. Date of manufacture printed in English on cases, cartons, and overwraps of frozen food by manufacturers is recommended for facilitating stock rotation in the channels of distribution.
- H. The stamping of individual food packages with date of shelf display is proposed as a consumer aid and to assure stock rotation at the retail store level.
- I. Time-temperature recording device with warning devices (bells, alarms) for temperatures greater than 0°F . in warehouses, transportation equipment, retail cabinets are in partial use, but should become voluntarily universal. Research on time-temperature devices for incorporation in or on frozen food packages should be reinitiated by the frozen food industry.

- J. In replacing old-style retail cabinet equipment at the store level, the preferred style should be vertical, door-closing freezer cabinets or units, fitted with air-curtains, to reduce mishandling of foods by retailers and consumers. These units should be capable of maintaining the frozen food at 0°F. or preferably lower, i.e., -5°F.
- K. Present open-top freezer cabinets should be provided with plastic, roll-top covers for overnight temperature control. Air-curtain types may be exceptions.
- L. Future supermarket layouts should encourage traffic patterns which facilitate frozen food pickup as a last item on the shopper's list.
- M. Kraft-style paper bags, similar to those for ice cream, should be provided in locations convenient to frozen food display units to protect against quality losses through temperature rises between purchase and consumer home storage.

III. TYPE OF FOOD AND PRODUCT GROUP

Frozen foods, by product group and category

Group	Percent- age of depart- ment sales	Percent- age of total sales	Category	Percent- age of depart- ment sales	Percent- age of total sales
Prepared foods	27.6	1.209			
			Dinners	12.0	.526
			Entrees	10.3	.451
			Meat pies	4.6	.201
			Other prepared specialties	.7	.031
				<u>27.6</u>	<u>1.209</u>
Juices	17.9	.784			
			Orange juice	13.4	.587
			Lemonade, other ades	1.4	.061
			Grape juice	1.1	.048
			Cocktail mixes	.2	.009
			All other juices, including punches	1.8	.079
				<u>17.9</u>	<u>.784</u>

Source: Chain Store Age, 1969 Supermarket Sales Manual (1), Lebhar-Friedman, Inc., New York, N.Y., July 1969. Used with permission of publisher.

Group	Percent- age of depart- ment sales	Percent- age of total sales	Category	Percent- age of depart- ment sales	Percent- age of total sales
Vegetables	17.2	.753			
			Regular, including combination	12.7	.556
			Boil-in-bag	3.9	.171
			Other specialty vegetables	.6	.026
				<u>17.2</u>	<u>.753</u>
Bakery products	13.2	.579			
			Fruit and cream pies	4.2	.184
			Bread and rolls, including dough	1.5	.066
			All other bakery	7.5	.329
				<u>13.2</u>	<u>.579</u>
Seafood, un- prepared	6.9	.302			
			Shellfish	3.7	.162
			Fish	3.2	.140
				<u>6.9</u>	<u>.302</u>
Potato and onion products	7.1	.311			
			Potatoes, french fried	4.2	.184
			Potatoes, other	2.0	.088
			Onion products	.9	.039
				<u>7.1</u>	<u>.311</u>
Fruits and berries	3.5	.160			
			Strawberries	2.8	.129
			All other fruits and berries	.7	.031
				<u>3.5</u>	<u>.160</u>
Meats, unprepared	2.2	.096			
				2.2	.096
Poultry, un- prepared	1.8	.079			
				1.8	.079
Soups	.3	.013			
				.3	.013
All other frozen foods	<u>2.3</u>	<u>.101</u>		<u>2.3</u>	<u>.101</u>
	100.0	4.387		100.0	4.387

IV. TYPE OF PROCESSING AND PRESERVATION and V. QUALITY CHARACTERISTICS

A. General

Frozen storage temperatures of 0°F. (-18°C.) prevent growth and action of enzymes of microorganisms and kill yeasts and some bacteria. Liquid water is removed from solution and stored as solid ice. Freezing is often preceded by blanching, which inactivates most enzymes and can accomplish some sanitary measures, e.g., pasteurization. Sophisticated packaging has a paramount role in the prevention of microbial recontamination, freeze dehydration or freezer burn, and physical abuse of package contents.

The general processing steps of frozen products listed in section III are noted in table 9. Freezing itself is accomplished by the use of subzero (°F.) temperatures down to -50°F.2/, but most commonly at -20 to -30°F.

Table 9.--Processing steps of frozen foods

Product	Cleaning	Grading	Peeling	Cutting	Juicing	Blanching	Mixed wet	Mixed dry	Packaging	Freezing	
Prepared foods	+	+	+	+		+	+	+	+	—	+
Juices	+	+	+	+	+				+		+
Vegetables	+	+	+	+		+	+	+	+	—	+
Bakery products								+	+		+
Seafood, un- prepared	+	+		+					+		+
Potato and onion products	+	+	+	+		+ Frying		+	+		+
Fruits and berries	+	+	+						+	—	+
Meats, unprepared	+	+		+					+	—	+
Poultry, un- prepared	+	+		+					+		+
Soups							+		+		+

Key: + Includes this processing step.

+ With or without this processing step.

— Indicates the sequence may be inverted, i.e., freezing may come before packaging.

2/ Immersion or spraying with N₂ produces much lower temperatures.

The methods of freezing in general commercial use are described by N. N. Potter (7) in Food Science, The Avi Publishing Company, Inc., Westport, Conn. (Used with permission of the publisher.)

"...There are three basic freezing methods in commercial use, these are freezing in air, freezing by indirect contact with the refrigerant, and freezing by direct immersion in a refrigerating medium. These three basic methods can be further subdivided in various ways....

"COMMERCIAL FREEZING METHODS		
Air Freezing	Indirect Contact Freezing	Immersion Freezing
Still-air 'sharp' freezer	Single plate	Heat exchange fluid
Blast freezer	Double plate	Compressed gas
Fluidized-bed freezer	Pressure plate	Refrigerant spray
	Slush freezer	

"...cold air may be used with various degrees of velocity progressing from still-air 'sharp' freezing to the high velocity blast freezer tunnel. The velocity of the air also may be used to subdivide and move particles of materials to be frozen, as in the case of fluidized-bed freezing.

"Indirect contact freezing includes those methods in which the food or the food package is in contact with a surface which in turn is cooled by a refrigerant, but the food or food package does not contact the refrigerant directly. In the case of liquid foods and purees, the food is pumped through a cold wall heat exchanger and frozen to the slush condition.

"Immersion freezing implies direct contact of the food or package with the refrigerant either by submerging the food in the cold liquid or spraying the cold liquid onto the food or package surface.

"With the exception of still-air 'sharp' freezing, all of the methods may be engineered for batch, semi-continuous, or continuous operation. Also with the exception of still-air 'sharp' freezing, all of the other methods generally are referred to as fast freezing methods...."

B. Quality Characteristics

The frozen food industry acknowledges the main basis for consumer quality judgments to be color and flavor. In addition to color and flavor, scientists in the industry consider texture and nutritional qualities to be significantly important factors. Care is taken to maintain all of these attributes. In the normal situation, public health hazards of frozen foods are of negligible magnitude. If the previously stated quality factors are controlled by low temperature, no possible public health hazard arises.

Scientific areas of research and concern in the field of frozen foods over the last 20 years are similar to those of the rest of the food industry. The areas of understanding and improving the microbiological, aesthetic, and nutritional qualities of food have been researched in that order of priority.

C. Specific Product Groups and Categories

1. Prepared Foods (Dinners, Entrees, Meat and Poultry Pies)

a. Dinners--The components of frozen dinners are generally pre-cooked, except for ingredients such as butter and garnishes. Prepared meat, poultry and seafood, and products made from these ingredients are sometimes breaded and deep fat fried before freezing.

Considerable manual or machine handling of the components of a dinner may occur before the final assembly is achieved. For instance, meat loaf or pot roast is first cooked, then sliced, placed into specific tray compartments; cooked vegetables are discharged into another tray compartment either automatically or by hand. Uncooked ingredients, such as parsley used as garnishes, may bacteriologically contaminate a portion of each meal if maximum sanitation is not practiced in preparing such ingredients.

The entire meal, with components in the respective compartments, is commonly covered prior to the freezing operation. The dinners normally require reheating in the compartmented containers before consumption.

The storage life of dinners varies with the nature of the components and the temperatures of storage. For example, turkey dinners, commercial and laboratory-made, limited by the time required for the turkey to become rancid and show a consequent flavor change, have an optimum storage life of 6 months at 10°F., 1-1/2 to 3 months at 20°F. [At 20°F., in addition to stale and rancid meat flavor occurrence, peas in the dinner suffered significant ascorbic acid losses after 3 months storage.] This means that the products are 3-6 times as stable at 10°F. as at 20°F. Antioxidants were ineffective in retarding the changes. Using fluctuating temperatures -10 to +10°F. and 0 to 20°F. did not produce significantly different results. Comparisons of pies freshly prepared from frozen (-30°F.), stored turkeys showed minor differences from the processed stored products.

Frozen seafood dinners vary in keepability, mainly according to the fattiness or leanness of the fish. The same relationship exists for keepability of unprocessed fish.

b. Entrees--While this product category was not defined by Chain Store Age (1) as to product variety, frozen prepared items such as meat stews, macaroni and cheese, fish sticks, fried chicken, and other similar dishes may be included in entrees. Because of such a diversity in composition, extensive generalization on storage behavior of these products is not possible. Several examples of storage follow.

Precooked frozen beefstew (A), pork stew (B), and Swiss steak (C) were stored at 0°F. (-18°C.), -10°F. (-23°C.), and -20°F. (-29°C.) for periods up to 9 months. Quality changes were evaluated from chemical and aesthetic

aspects. No definite conclusions were reached on shelf-life time. When fresh frozen, all (32/36) of the samples suffered quality losses compared with their fresh counterparts. The order of loss was A, C, B. After 9 months of storage, the order of quality loss was still A, C, B--yet all were still acceptable (9).

Frozen fried chicken can be stored no longer than 6 months at 0 to -10°F. (-18 to -23°C.) before rancid flavor develops.

Frozen fried fish products may often be limited to 3 months of shelf life (10). However, here again, there are considerable variations in tolerance, depending on ingredients and other factors.

Precooked frozen meat foods are more susceptible to microbiological infection than are frozen raw meats, because contamination often occurs in the preparation, handling, and exposure after cooking, yet before the freezing operation.

Precooked seafood products vary widely in their composition and stability. The preparation of fish sticks includes the following steps:

- (1) Fish harvesting and chilling aboard fishing vessels
- (2) Cleaning and gut removal
- (3) Preparing fish fillet blocks and subsequent freezing
- (4) Sawing or cutting frozen fish fillet blocks into fish sticks
- (5) Coating raw fish sticks, i.e., breading
- (6) Precooking the coated raw fish sticks
- (7) Packing and freezing the coated, precooked fish stick (11).

In the processes used, there is little probability of any serious loss of amino acids from the seafoods. There is some loss of natural vitamins but, in general, the loss is not serious. Mineral loss is insignificant, owing to processing.

When precooked, frozen fishery products such as crabmeat, fish sticks, or breaded shellfish are frozen, the thawed product may be eaten with or without further cooking, or after inadequate heating. Under such conditions, should any pathogenic bacteria be present, they would constitute a very real health hazard. Accordingly, preparation of such precooked frozen seafood products must be made under the most rigid sanitary conditions to prevent potential health hazards to the consumer. Handling under the best sanitary conditions is, of course, the only acceptable practice to be used with all foods, however processed and whether eaten raw or cooked.

Also included in prepared foods are frozen precooked boneless turkey roasts. A study by Martinsen and Carlin (13) showed that these can be stored at 0°F. (-18°C.) at least 7 months in Cryovac (R) bags, without significant quality loss.

c. Meat and Poultry Pies--Products in this category vary considerably in size, shape, and composition from one manufacturer to another. Some are distributed with raw dough crusts, and uncooked or partially cooked components, requiring the consumer to do the baking while others are distributed fully baked, requiring only short reheating before consumption. The present trend is to market unbaked pies.

Poultry pies may be kept for 6 months at 10°F. or lower, without significant quality loss.

2. Juices (Orange, Grape, Pineapple, Other Juices, Lemonade and Other Ades, Cocktail Mixes, and Other Related Items, Including Punches)

By far the most important concentrate in terms of sales volume is frozen orange juice concentrate (14). Frozen orange juice concentrate is made by concentrating fresh orange juice to slightly less than one quarter of its original volume, using one of several different concentrating methods. Usually, a small amount of unconcentrated juice is replaced in the concentrated juice to restore fresh flavor. This brings the juice to a 4 to 1 concentration, so that ordinarily 3 canfuls of water are added to 1 canful of the frozen orange concentrate to prepare it for consumption. Small amounts of orange peel oil may also be added to the concentrated juice before freezing, to compensate for flavor lost during concentration. Some processors heat the juice at some stage to improve the retention of the natural cloudiness of the original juice, which often settles out on storage because of enzyme action.

The concentrated juice is usually packaged in laminated containers (cans) and hermetically sealed. Such containers (cans) have varied compositions: (1) foil-covered paper bodies with metal ends; (2) aluminum bodies with aluminum or tin plate ends; and (3) enameled tin plate cans.

Freezing is accomplished in blast freezers, or immersion freezing to achieve the contents temperature of lower than 0°F. (-18°C.) as soon as possible after processing. Frozen concentrated orange juice packed late in the season usually has better color and flavor than those packed during mid-season (15). Although color and flavor are important qualities of frozen orange juice, the loss of "cloud" through settling is considered the most important quality factor affecting its stability during storage (14).

When frozen concentrated orange juice was subjected to improper storage conditions, it required at least 3 days at room temperature (70°F.) to cause cans to swell or burst, and at least 5 weeks at 40°F. During these periods of time, only yeast organisms grew (16).

Nutrient retention has been measured in frozen 4 to 1 concentrations of orange juice, tangerine juice, and grapefruit juice at temperatures -8°F., +10°F., +20°F., +32°F., and +40°F. Average retention of ascorbic acid in all concentrates at -8°F. for 12 months was slightly over 98 percent, with gradual decrease with increasing storage temperature to about 95 percent loss at 40°F. in 12 months (table 10).

Other fruit juices are produced in a manner generally similar to concentrated products, with modification of concentration and some processing details. Generally, some method of removing and saving the delicate flavor and aroma portions is applied to capture, store, and then reintroduce them into the concentrated juice.

Ades and other products are made by blending juices and other flavors and by adding sugar.

Table 10.--Percentage retention of ascorbic acid in 42° Brix (fourfold) concentrated citrus juices after storage for 12 months at various temperatures

Storage temperature	Percentage of ascorbic acid retention in--						
	Hamlin orange	Pine-apple orange	Valencia orange	Dancy tangerine	Duncan grapefruit	Marsh grapefruit	Average
	-----Percent-----						
-8°F.	100.0	98.7	99.2	94.0	98.4	98.8	98.2
10°F.	99.0	98.0	97.9	93.5	97.9	98.8	97.5
20°F.	98.7	96.7	96.7	90.7	98.1	98.3	96.5
32°F.	97.6	96.0	96.2	90.9	97.7	98.6	96.2
40°F.	97.1	94.7	95.9	89.7	97.1	97.1	95.3

Source: Huggart, Harman, and Moore in J. Am. Dietetic Assoc. (17). Used with permission of the American Dietetic Association.

3. Vegetables--Vegetables are generally delivered to the processing station and processed as soon after harvesting as possible to minimize quality loss. For example, corn loses only 5 percent of its sugar (generally, by conversion to starch) in 24 hours storage at 32°F. (0°C.), but loses nearly 60 percent of it in the same time period at 68°F. (20°C.) (18).

Vegetables intended to be frozen are usually washed and blanched, otherwise activating enzymes would cause undesirable softening and/or darkening of the products. There may be some loss of nutrients in frozen vegetables, but this is primarily due to loss suffered during preparation. For example, some of the vitamins, such as ascorbic acid, can be lost from vegetables during washing, and especially during blanching (12). The loss is also dependent on the method of blanching used, steam being less harmful than hot water immersion.

It has been shown that losses of vitamins from foods stored at 0°F. (-18°C.) are negligible (12). Stored vegetables may lose consumer acceptability through loss of customary color, owing to loss of natural pigments such as chlorophyll. But vegetables stored at 0°F. (-18°C.) or lower lose color very slowly. For example, the retention of chlorophyll in blanched peas falls from an original 96 percent to about 90 percent in 1 year. This change, while detectable by analytical methods, is not conspicuous to the human eye (2).

4. Bakery Products (Bread and Rolls, Pies, Cakes)--Although significant subdivisions can be made of these divisions, and numerous variables can restrict storage life, the diversity of combinations would become too unwieldy for discussion if all such combinations were to be considered individually. Hence, only a few are discussed here.

Suitable wrapping is an essential requirement for frozen storage of baked goods. Speed of freezing is also an essential variable for most products. Bread and rolls can be adequately stored for 2 to 6 months (14) (19) (20). Staling of bread is the result not only of evaporation of moisture from the bread, but also because of retrogradation of the pregelatinized starch (14) (18) (20).

Fruit pies can be stored for 2 to 6 months (19). Variability of shelf life is attributed to several factors. The beginning of rancidity ends shelf life, and the development of crust soggiess ends consumer acceptability. A preference has been demonstrated for unbaked fruit pies rather than baked ones, because frozen baked pie crusts tend to become brittle. Baking pies after freezing, or just before use, minimizes crust soggiess (14).

Cakes cover an assortment of basics and combinations with an infinite variety of icings. In some instances, the icings are the limiting factor in storage life. Cakes can generally be stored for 2 to 6 months (18). To illustrate a few of the differences in the keeping quality of cakes, the USDA recommendations to consumers for home storage at 0°F. are listed (19).^{3/}

Angel: 2 months	Pound: 6 months
Chiffon: 2 months	Yellow: 6 months
Chocolate layer: 4 months	Danish pastry: 3 months
Fruit: 12 months	Donut: 3 months.

5. Seafood, unprepared--Included in this group are both fish and shellfish, which vary widely in composition and stability.

The differences in types of raw fish account for some of the wide variations in storage life of fish. Some types keep longer than others, i.e., fatty fish lose acceptability more quickly than lean fish. While there are noticeable changes in the quality of fish as storage progresses, only minor loss of nutrients occurs, especially of amino acids. The vitamin content of fish does not decrease substantially during frozen storage (12).

During frozen storage, there is a gradual change in texture, which results in toughening as storage time progresses. This change is attributed to the gradual deterioration of protein, and is one of the factors determining the end of shelf life (21). With the passage of time, there is also a progressive flavor change in frozen fish. The normal fresh flavor characteristic of each species of fish gradually diminishes, rendering it less palatable, until a new, undesirable flavor develops. This flavor is described as rancid and since it increases in intensity, it contributes to the end of shelf life.

For best shelf life, fish must be frozen soon after being caught. Delay in freezing causes development of a fishy flavor (protein decay manifested by production of trimethylamine, ammonia, and also oxidation of fish oils) which shortens storage life (21). Fish vary widely in susceptibility to oxidative changes, which cause flavor changes. Since oxidation is primarily

^{3/} Since USDA Bulletin No. 69 is for homemakers, it presupposes an initial storage period by the manufacturer, distributor, and merchant.

caused by air (oxygen), storage life is improved by excluding air from fish as quickly and as completely as possible. While the production of any good quality frozen food depends on the quality and freshness of the starting material, it is especially important in frozen fish. Handling of shellfish, while differing from the handling of conventional fish, requires similar precautions and observance of the most critical procedures for rapid handling from harvest to freezing.

Fish and shellfish are exceptionally good sources of protein and mineral elements required by man. Losses of mineral elements, when they occur, are mainly physical, owing to the discard of liquids from fresh fish products, not to processing procedures. When fish are frozen and stored at the usual storage temperatures, the bacteria present in the fish tissue are, for the most part, inactivated. A portion of them are killed, but those surviving will, when the fish is thawed, grow once more and contribute to spoilage of the thawed fish (21). Bacteria present in frozen fish normally are destroyed when the fish is cooked. If any pathogenic bacteria are present, they will be destroyed during cooking so that ordinarily no health hazards exist.

6. Potato and Onion Products--Because of the likelihood of darkening of items such as french fried potatoes, these and similar items are generally "parfried," that is, cooked in oil just long enough to inactivate the enzymes before they are frozen. Final cooking is done immediately before serving.

7. Fruits and Berries--Fruits and berries generally follow a shelf-life pattern similar to that of vegetables, except that their storage stability is usually somewhat longer, their pH being lower than that of vegetables. (Acidity or low pH protects products better against microorganisms, for example.)

Fruits, like vegetables, suffer little loss of nutrients during storage. Loss of color, one of the main bases of judgment of unsuitability by the consumer, is also retarded by storage at 0°F. (-18°C.) or below. However, fruit, such as peeled peaches, require some type of protection, e.g., the addition of ascorbic acid, sugar syrup, or both. This prevents non-enzymatic rather than enzymatic browning. In this case, shelf life can be dependent on the geometry of the package. For instance, less browning is likely to occur in a moderately tall, round container, than in a relatively flat, shallow package, because of the greater amount of fruit exposed to the air in the latter type of package. Small surface areas keep the fruit sufficiently covered with protective adjuncts such as syrup. This immersion, therefore, adds to the normal stability of the fruit (22).

8. Meats, unprepared--The keeping quality of fresh meats, unground, varies with the animal. For example, frozen fresh beef will keep 10 to 13 months (18) (19) (23). Frozen ground beef generally has a shelf life of 3 to 8 months (22). Frozen lamb will keep 6 to 12 months. Variation may be caused by, among other reasons, the particular cut of meat. Frozen fresh pork will keep 4 to 8 months; frozen veal will keep 4 to 8 months, cutlets having the shorter life (19) (23). Frozen hams generally have a storage life of 6 to 8 months (19). Other processed meat products, such as bacon, frankfurters, and pork sausages, vary in storage life from 4 to 6 months (23).

In the frozen storage of meats, there is a wide diversity of shelf life, depending on many factors, e.g., the animal source, the size of the cut, the anatomical location of the cut, difference between muscular and glandular meat, the amount and type of fat, the nature of physical treatment such as chopping and comminuting, as well as processing methods such as smoking, brining, and blending with other ingredients.

Nutrients are generally well preserved, although there are some losses occurring during thawing and curing (12).

9. Poultry, unprepared--Chicken, turkey, duck, and goose are considered in this product group. Of these, chicken and turkey have the longer storage stability, with chicken being considered somewhat more stable than turkey (24). The usual practice is to clean and eviscerate poultry prior to freezing.

Numerous factors affect the storage life of poultry, on which the following figures give a general perspective:

Frozen chicken, whole eviscerated: 6 to 12 months (18, 19, 23)

Frozen turkey, whole eviscerated: 10 to 12 months (19, 23)

Frozen duck, whole eviscerated: 6 to 10 months (19, 23)

Frozen goose, whole, eviscerated: 6 months (19).

Although the nutrient losses are minor in normal processing of poultry, they are significant in precooked poultry. However, these are normal processing losses and occur whether or not the poultry is frozen (12).

10. Frozen Soups, Cooked (for example, oyster stew)--Frozen soups require sanitary handling before canning, sealing, and freezing to prevent bacteriological spoilage, because these products are not sterilized after canning. Sterilization is omitted because the high temperature required reduces the original quality of flavor, and possibly also the quality of color and consistency in delicate foods suited for freeze canning.

VI. PROCESSING AND STORAGE QUALITY LOSS FACTORS

A. Identification of Potential Causes of Quality Losses

The greatest potential cause of quality loss is high storage temperature, i.e., greater than 0°F. Nonrotational handling by the distribution trade and consumer errors in home storage and preparation are additional causes of quality loss. Other quality loss areas were described in sections IV and V above. The order of quality loss which occurs in frozen foods is aesthetic rather than nutritional. Table 11 presents the various steps at which quality is lost in frozen foods.

The importance of temperature, correct handling practices, and stock rotation throughout transportation, warehousing, and retailing cannot be stressed enough. The obvious weaknesses of these phases of events cannot be demonstrated because this information is not published. Its importance is obvious, however, when the number of scientific and technical articles which

Table 11.--Steps of potential quality losses in frozen food

Process step	Quality													
	Q _A				Q _N					Q _M				Q _F
	Aesthetic				Nutritional					Microbial				Func- tional
	Color	Flavor	Texture	Vitamins	Mineral	Protein	Carbohy.	Fat	Bacteria	Yeasts	Mold	Package	Product	
Food Industry Operator:														
Preprocessing	+		+	+						+	+	+		
During processing and preservation	+		+	+	+	+		+	+					+
Storage in the factory	+	+	+	+				+	+					+
Distribution Cycle:														
Transportation to sales region	+	+	+	+				+	+					+
Wholesale storage warehousing	+	+	+	+				+	+					+
Transportation to stores	+	+	+	+				+	+					+
Retailing:														
Retail handling	+	+	+	+				+	+					+
Case storage	+	+	+	+				+	+					+
Shelf storage	+	+	+	+				+	+					+
Consumer:														
Consumer trans- portation	+	+	+	+				+	+					+
Consumer storage	+	+	+	+				+	+					+
Consumer use			+	+	+				+			+		

Key: + indicates possible quality loss.

consider it in experiments is noted. Relevant data from studies by Industry Source #355FIS are included later in this section of the survey.

B. Food Industry Practices for Quality Maintenance

1. Trade Associations--The Association of Food and Drug Officials of the United States (AFDOUS) (4), a nongovernmental group, has promulgated the AFDOUS Frozen Food Code. AFDOUS developed this code in cooperative efforts with the frozen food industry and its trade associations, the USDA, and the U.S. Public Health Service. Part of the table of contents of the Code is shown below and demonstrates a total coverage from plant to retail outlet. However, it excludes the consumer as a source of quality loss, and also excludes advice for home storage.

Section A. Definitions

Section B. Frozen Food

1. General

Section C. Construction and Layout of Frozen Food Plants

1. Coverage

2. Location

3. Separation

4. Water Supply

5. Plant Waste Disposal

6. General Plant Layout

7. Plant Construction

8. Plumbing and Floor Drainage

9. Lighting, Ventilation

Section D. Design and Construction of Frozen Food Processing Equipment

1. Coverage

2. General Principles

3. Equipment Classification

4. Equipment Groups A, B and C - Materials, Design and Construction

5. Installation of Equipment

6. Connections

Section E. Operating Practices for the Commercial Manufacture of Frozen Food

1. Handling and Storage of Materials

2. Personnel Hygiene

3. Plant and Equipment - Sanitation

4. Preparation and Processing

5. In-Plant Freezing

Section F. Transportation

1. Equipment

2. Handling Practices for Over-the-Road Transportation

3. Handling Practices for Route Delivery

4. Sanitary Provisions

Section G. Warehousing

1. Equipment

2. Handling Practices

3. Sanitary Provisions

Section H. Retail

1. Equipment

2. Handling Practices

Adopted in 1961 after several years of discussion and research, the code was designed for use as a guide to legislative regulation of frozen foods. Industry attempts to conform to, or exceed, the measures in the code.

The National Fisheries Institute, Inc. (25) has an undated publication titled "Recommended Voluntary Operating Practices" for the handling of consumer packaged frozen foods which is also a cooperative industry resolution. It contains a suggested program for the lowering of storage temperatures for various segments of the industry.

The Canadian Food Processors Association (26) has a publication, "Distribution Practices--Frozen Foods," which contains quality maintenance information similar to the AFDOUS Frozen Food Code. In the United Kingdom, the National Association of Frozen Food Producers (27) publishes similar information.

AFDOUS has additional publications on "Microbiological Examination of Precooked Frozen Food" (28) and "Recommended Bacterial Limits for Frozen Precooked Beef and Chicken Pot Pies" (29), which are not to be confused with the AFDOUS code.

The Fruit and Vegetables Preservation Research Association of England (30) has published a Manual of Methods for the Bacteriological Examination of Frozen Foods, which is subject to biennial review. Methods have been approved and accepted by the United Kingdom's National Association of Frozen Food Producers.

All the foregoing publications are widely known and distributed among the frozen food industry, the transportation industry--both rail and truck, warehousing groups, and retailers associations.

The following national associations endorse in principle some of the above programs.

American Trucking Associations
National Association of Food Chains
National Association of Frozen Food Packers 4/
National Association of Refrigerated Warehouses
National Association of Retail Grocers of the United States
National Fisheries Institute
National Frozen Food Association
National Prepared Frozen Food Processors Association

2. The Food Industry--The following information was supplied by various industry sources:

Number 745FIS stated: "...Our products are coded based on the date of production...."

4/ In September 1970, this association (5) as organizer of the Frozen Food All-Industry Coordinating Committee, issued a Code of Recommended Practices for the Handling of Frozen Food. It is included at the end of this chapter.

"Our field representatives are continuously looking at our products and report back to headquarters their evaluation of the quality. Our company policy states that distributors have to adhere to strict requirements for product temperature control, equipment and handling procedures.

"Our plant is continuously inspected to see that it is insect free, clean, and properly maintained. Production personnel are required to use good sanitary practices. Our program is monitored by the American Institute of Baking using a system of unannounced inspection....

"PRODUCT QUALITY

"A. (Company name) products shall be held at an air temperature of 0°F. or lower except for defrost cycles, loading and unloading, or for other temporary conditions beyond the immediate control of the person or company under whose care or supervision the products are held.

"B. The internal product temperature of our products shall be maintained at 0°F. or lower except when the product is subjected to the conditions above; then the internal product temperature shall not exceed 10°F., and such product shall be returned to 0°F. as quickly as possible.

"Vehicles for transporting our products shall be equipped with a combination of insulation and mechanical or nitrogen refrigeration systems capable of maintaining an air and product temperature of 0°F. or lower while loaded...."

"HANDLING PROCEDURES

"A. Vehicles must be precooled to an air temperature of 20°F., or lower before loading.

"B. The mechanical refrigerating unit of vehicles shall be turned on and doors of vehicles shall be kept closed during any time interval when loading or unloading operations cease.

"C. All interior surfaces of vehicles and devices used for transporting (company name) products shall be clean and free of objectionable odors before and during loading and in transit...."

Another company (#165FIS) stated:

"Frozen Foods--The product is returned to the nearest (company name) plant for disposition when the first signs of quality change or mishandling are reported by the (company name) Sales Force. There is a continual battle for shelf space for frozen foods in supermarkets. Turnover time in the supermarket determines profitability and products with long turnover are discontinued. Because of the limited freezer case capacity in relation to the large number of items available, an independent research organization estimates that we have an average out-of-stock condition of about 10% at all times."

A trade source, #625FIS, stated in reply to our letter that it conducted a survey over a 3-year period, 1966-69, with the following results:

"In all of these samplings the temperature of the product in the retail case was noted and reported. Most new equipment is quite good and temperatures of the product was usually from a little below 0°F. to about 5° above zero. However, many of the older cabinets are not carried at these low temperatures and product temperatures of as high as 15 - 20° above were not exceptional....

"...several pallets of frozen foods on the floor of supermarkets with possibly one clerk pricing and placing the merchandise in the frozen food cabinets. This operation taking all day resulted in all outside surfaces of the cartons becoming warm and in some cases thawing to a point where the product had softened. Also it rarely occurs that the products are rotated. The operator merely places the new stock in front or on top of the stock in the cabinet. We have found on the very bottom of a pile merchandise a year or more old with current production in front...."

In other letters, the trade source stated:

"However, the inevitable fluctuation of the average temperature in frozen food cabinets in the retail outlets, together with the almost total disregard of good practices in receiving and placing the frozen products in the cabinets, and in most cases the lack of rotation of stock, results in unnecessary reduction of quality...."

Industry is aware of the problems of temperature fluctuation and has studied the effects on shelf life of fluctuation. The schedule of temperatures, simulating transportation, and the results of investigations by #355FIS are presented in the following tabulations. All products were evaluated in their consumer packages, i.e., paper board carton with coated paper overwraps.

"Storageability of Various Products
Simulated Distribution Temperature Storage Schedule"

Used to simulate the temperatures encountered in the commercial distribution of frozen foods, and to determine the consequent effect on quality of temperature.

<u>Storage life</u>	<u>Storage simulation conditions</u>		
Equivalent storage at 0°F.	First stage of storage	Mid storage stage	Final stage of storage
3 months)		2 months @ 8°F.)	
6 months)		2 months @ 8°F.)	
9 months)	2 weeks @ 25°F.	8 months @ 8°F.)	2 weeks @ 25°F.
12 months)		11 months @ 8°F.)	

"Stability of frozen foods at three USDA temperature levels***"

Days of storage that give
equal quality reserves

<u>Frozen food and factor evaluated</u>	<u>0°F.</u>	<u>10°F.</u>	<u>20°F.</u>
Boysenberries, 1st flavor or color change	360-450	100-150	40-50
Cherries, browning	-	-	10
Chicken, fried, rancidity	.273	182	60
Chicken, to-fry*	180	90-300	30-180
Chow mein, good flavor	-	300	-
Green beans, 1st color change	101	28	8
Green beans, 1st flavor change	296	53	30
Peaches, 1st color change	365**	45	6
Strawberries, color	365	65	9
Strawberries, flavor	365	56	9
Trout, appearance and rancidity	480	135	75
Turkey dinners and pies, flavor	180	180	-

* Length of storage at a given temperature varies with type of packaging.

** Peaches after 0°F. storage for one year failed to show a detectable change in color.

*** These are USDA Western Utilization Research and Development Laboratory data (1967). They are now recognized as misleading as they imply a determinable shelf life was determined. They were based on the first detectable difference by an expert panel and do not represent commercial quality or consumer quality evaluations on a subjective basis.

"Storageability of various products"
(Summary of nine years of storage studies)

Time product remained in original grade

<u>Food item</u>	<u>0°F.</u>	<u>Sim. Dist.</u>	<u>-10°F.</u>
Asparagus spears	1 Y+		1 Y+
Beans, cut green	1 Y+		1 Y+
Beans, cut wax	1 Y+		1 Y+
Beef pies	2 Y+		
Beef dinners (meat, sauce, peas, carrots, au gratin potatoes)	6 M+		6 M+
Beef dinners (meat, gravy, peas, potatoes)	1 Y+		1 Y+
Chicken, fried	2 W+		
Chicken, raw parts	1 Y+	1 Y+	

Y = years; M = months.

Time product remained in original grade

<u>Food item</u>	<u>0°F.</u>	<u>Sim. Dist.</u>	<u>-10°F.</u>
Chicken pies	1 Y+		1 Y+
Chicken, fried	19 M+	3 M	
Chicken, fried (with foil overwrap)	6 M-		
Corn, whole kernel	1 Y+		1 Y+
Corn, whole kernel	15 M	6 M	
Fish sticks	27 M+	3 M-	
Lemonade	2Y, 5M, 3Y, 4M+, 2Y, 4M+, 2Y, 11M+	Packed at different locations	
Orange juice	8Y+, 7Y+, 6Y+, 5Y+, 4Y+, 3Y+, 2Y+	"	"
	Storage time of 4Y+ occurred most often		
Peaches	1 Y+		1 Y+
Peaches; halves, slices	2 Y+		
Potatoes	1 Y+	1 Y+	
Spinach, chopped	1 Y+		1 Y+
Squash	13 M+		
Strawberries	11 M+		11 M+
Swiss steak dinner	6 M+	6 M+	
Turkey dinner	6 M+	3 M-	
Turkey pies	14 M	1 Y	

A "+" following a measure of time indicates greater than.

A "-" following a measure of time indicates less than."

The same company's (#355FIS) odd lot storage schedule was detailed as follows:

"ODD LOTS STORAGE SCHEDULE"

Months storage at 0°F. after which
products enter:

Products assigned to the group:

<u>Category</u>	<u>Category</u>	<u>Category</u>	
A (still good)	B (questionable)	C (destroy)	
6	9	12	Fruit pies, macaroni and cheese, chicken dinners
6	15	18	Meat pies
9	15	18	All dinners except chicken, raw fish products, onion rings, fish portions, perch, mushrooms

Months storage at 0°F. after which
products enter:

Products assigned to the group:

Category

A (still good)	Category B (questionable)	Category C (destroy)
----------------------	---------------------------------	----------------------------

12	21	24	Raw poultry, precooked fish (not included in preceding), tangerine concentrate, chicken a la king
18	33	36	All juice concentrates except tangerine
18	27	30	Fruits, vegetables, potato products
4	6	9	Tomato sauces with vegetables

"A product is assumed to be 'A' quality from time of production until it enters Category A. When a product enters Category A it is still A quality but should be moved as soon as possible. When it enters Category B it should be sold only if there is assurance that the product is still good. When it enters Category C, the lot will be destroyed if there are 100 cases or less in the lot, and if more than 100 cases, serious thought will be given to immediate disposal by one means or another."

C. Channels of Distribution

In a recent study of layout patterns and handling procedures in frozen food warehouses, Lundquist (31) showed that economic and quality savings could be made. Systems were developed which resulted in a reduction by 22 percent in man-hours for handling by improvements in equipment, distribution of work crews, and work methods. Consequently, temperature fluctuations of the frozen products were reduced. A major frozen food processor, #165FIS, limits warehouse storage time at -10°F. to 12 months, based on times established by its research department. After leaving the warehouse, prime condition is maintained throughout the trade channels, except in cases of severe abuse. The company's sales personnel are empowered to return to local distribution centers for examination and disposal any mishandled food or any product which shows a quality change. The same company, #165FIS, has developed a film, bookshelf display, and placards for training retail store employees. This program stresses the marketing aspects of frozen foods and their quality control by 0°F. temperature maintenance, storage below freezer cabinet load line, and cabinet space management.

In 1960, the Cooperative Extension Service of the University of Massachusetts (32) published a manual for its personnel to assist in their training on handling and merchandising of frozen food. Several tables were selected from the publication by Sawyer, Midura, and Vondell, to demonstrate quality loss areas in the channels of distribution, which are equally applicable to home storage. (Used with permission of the Cooperative Extension Service, University of Massachusetts.)

"Quality Loss During Cooling*"

<u>Temperature range</u>	<u>Percentage loss in high quality life</u>	<u>Equivalent No. of days at 0°F.</u>
From 30°F. to:		
0	19.8	83
10	18.6	78
15	18.0	75
20	17.0	71
25	12.3	51
From 25°F. to:		
0	7.6	31
10	6.3	26
15	5.6	23
20	4.7	20

*Temperature changes in frozen foods when thawed at 65°F. and refrozen at 0°F. in still air.

"Periods of Time at Various Temperatures That are
Approximately Equivalent in Their Effect on
Quality Loss of Frozen Foods"
(based on the loss equal to that experienced
at 0°F. for 1 year)

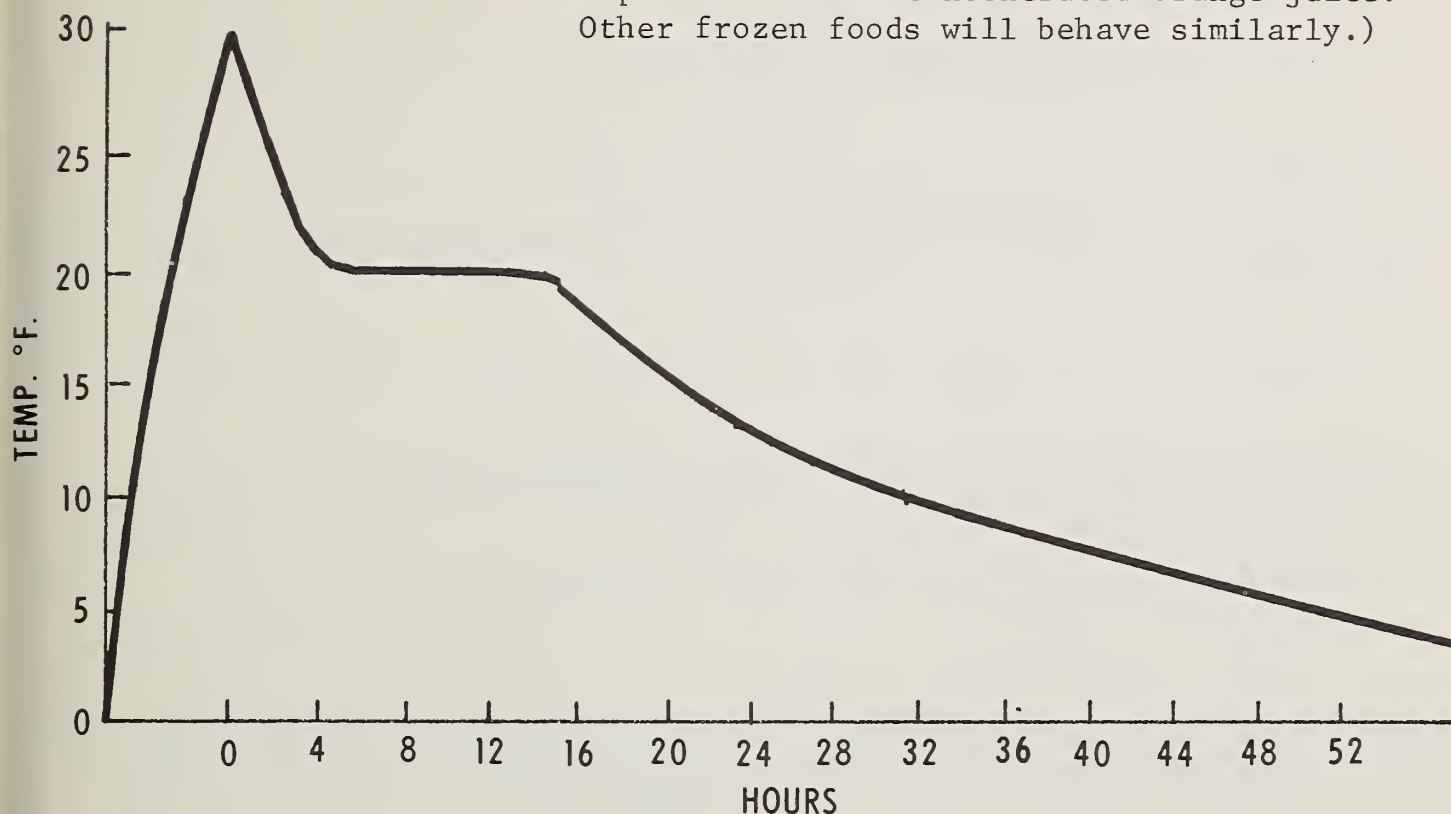
<u>Temperature</u>	<u>Sensitive fruits and vegetables*</u>	<u>Other fruits and vegetables**</u>	<u>Turkeys and cut-up chicken***</u>
0°F.	1 year	1 year	1 year
5°F.	5 months	5 months	--
10°F.	6 weeks	2 months	6 months
15°F.	3 weeks	1 month	--
20°F.	1 week	2 weeks	3 months
25°F.	2 days	1 week	--
30°F.	1 day	3 days	--

* Where discoloration occurs, such as in peaches and cauliflower.

** Where discoloration is not as critical, but does occur and flavor changes take place.

*** Whole chicken is more stable than turkey.

"Temperature Changes in Frozen Foods When Thawed at 65°F. and Refrozen at 0°F. in Still Air." (Top corner packages of a standard carton of frozen foods. These data represent frozen concentrated orange juice. Other frozen foods will behave similarly.)



Source: These data are from results of a research project on Time-Temperature of Frozen Foods, in part supported by the Refrigeration Research Foundation, and conducted by the Western Utilization Research and Development Division of the Agricultural Research Service, USDA, in Albany, Calif. (33).

"Temperature Changes of Thawed or Partially Thawed Frozen Foods When Placed in a 0°F. Still Air Storage Room

(Top corner packages of a standard carton of frozen foods. These data represent frozen concentrated orange juice. Other foods will behave similarly.)

If the product is 30°F., it will take approximately 2 hours to reach 25°F.

If the product is 25°F., it will take approximately 2 hours to reach 20°F.

If the product is 20°F., it will take approximately 16 hours to reach 15°F.

If the product is 15°F., it will take approximately 12 hours to reach 10°F.

If the product is 10°F., it will take approximately 20 hours to reach 5°F.

(Another way of stating it is:)

If the product is 30°F., it will take approximately 52 hours to reach 5°F.

If the product is 25°F., it will take approximately 50 hours to reach 5°F.

If the product is 20°F., it will take approximately 48 hours to reach 5°F.

If the product is 15°F., it will take approximately 32 hours to reach 5°F.

If the product is 10°F., it will take approximately 20 hours to reach 5°F.

Source: These data are from results of a research project on Time-Temperature Tolerance of Frozen Foods, in part supported by The Refrigeration Research Foundation, and conducted by the Western Utilization Research and Development Division of the Agricultural Research Service, USDA, in Albany, Calif. (33).

"Temperature Changes in Frozen Foods When Held at 65°F.

(Top corner packages of a standard carton of frozen foods. These data represent frozen concentrated orange juice. Other frozen foods will behave similarly.)

If the product is	0°F.,	in 1 hour	it will be	approximately	8°F.	
" "	" "	5°F.,	" 1	" "	" "	13°F.
" "	" "	10°F.,	" 1	" "	" "	18°F.
" "	" "	15°F.,	" 1	" "	" "	22°F.
" "	" "	20°F.,	" 1	" "	" "	26°F.
" "	" "	25°F.,	" 1	" "	" "	30°F.

(Another way of stating it is:)

If the product is 0°F., it will be completely thawed in approximately 6 hours.

If the product is 5°F., it will be completely thawed in approximately 5 hours.

If the product is 10°F., it will be completely thawed in approximately 4 hours.

If the product is 15°F., it will be completely thawed in approximately 3 hours.

If the product is 20°F., it will be completely thawed in approximately 2 hours.

If the product is 25°F., it will be completely thawed in approximately 1 hour."

Source: These data are from results of a research project on Time-Temperature Tolerance of Frozen Foods, in part supported by The Refrigeration Research Foundation, and conducted by the Western Utilization Research and Development Division of the Agricultural Research Service, USDA, in Albany, Calif. (33).

According to one company (#530FIS):

"Stock rotation in warehouses and stores is of primary importance in bringing the consumer maximum quality. To achieve this, it is most important that the coding schedule be adhered to by all parties concerned.

"The Coding Program consists of two basic types: (1) rotation coding, (2) date coding.

"Products that are rotation coded are the longer shelf life products. These items are subject to normal store rotation, need not be removed from the sale due to shelf life, since quality change is virtually nonexistent for extended periods of time. However, the oldest coded packages should be rotated to the first selling position so as to keep stock as fresh as possible.

"The Processed Foods Division has revised their system for rotation items which are called production code items. The system indicates the year, period and calendar code for the day the item was produced. (example: May 2, 1969 production will bear the code 905 where the 9 indicates 1969, the 05 indicates the 5th period and the EN is the calendar code indicating the production day. The primary advantage of this system is to permit stock rotation once per period and simple identification of the age of product. The lowest number is the oldest product, that is, 905 is older than 910 and 913 is older than 001. (SIC)

"Products that are dated are subject to shorter shelf life because of quality changes, thus must be removed from sale at the date indicated. These dates have been determined so that the consumer will have a reasonable opportunity to consume the product and still find it of satisfactory quality. Thus at the expiration of the outdate, product should still be satisfactory for consumer to enjoy."

D. Consumer Factors

1. Situation in the United States--The habits of consumers leave much to be desired. When bad habits prevail, whether through lack of understanding, knowledge, or interest, they cause quality losses in both the

aesthetic and nutritional areas. An example of abuse is leaving frozen foods after purchase in automobiles for excessive periods of time so that a rise in food temperature occurs. When the packages are refrozen, aesthetic quality losses can take place, and health hazards can arise, e.g., refreezing of fish and hamburger. Health hazards are usually avoided because goods never quite reach 36°F., the point of commencement of pathogenic microbial growth. Cooking in excessive amounts of water, i.e., not adhering to the manufacturer's package instruction, is a source of nutritional loss.

The processing steps shown in table 9 (p. 151) indicate the places where there are potential quality losses for the consumer, and the particular quality property damaged.

Deterioration of frozen food quality possibly occurs more in the consumer phase of the food cycle than in any other phase (34). Several reasons account for this. First, the consumer has not been educated enough in the technicalities of quality loss factors, particularly those of temperature requirements. The food industry fails to provide adequate instructions on its packages. Also, the consumer has not received wide enough education through media services (magazines, etc.) on the subject of food quality. Evidence in the survey literature points to education at all other levels of the food distribution cycles, whether or not such education produces positive responses. Second, frozen food equipment manufacturers have not designed their equipment with sufficient safeguards to permit the achievement of the low-temperature levels of 0°F., or below, which are necessary to maintain frozen food at best quality levels. If this were done even surreptitiously, it would prevent quality loss and help the consumer.

Some of the above remarks are obvious from the following tabulations compiled from Consumer Report (35), in which various frozen food storage units were evaluated. They show that 0°F. is not achieved as an average temperature throughout the whole freezer storage unit.

NO-FROST SIDE-BY-SIDE REFRIGERATOR-FREEZERS*

Freezer Operating Temp.	Refrigerator Operating Temp.
0°F. at Center	
10°F. at Bottom	37°F.

*Compiled from results of testing 15 commercial models, under load-operating conditions.

NO-FROST TOP-REFRIGERATOR-FREEZERS*

Freezer Operating Temp.	Refrigerator Operating Temp.
0°F. at Center	
10°F. at Door	37°F.

*Compiled from results of testing 13 commercial models, under load-operating conditions.

It is notable that Consumer Reports base their tests on "...convenience..., price and performance...." They stated, "...in the freezer., 0°F. is the desirable temperature, although 5°F. is enough to keep the food for a fairly long time...." "...as for the freezer, 5°F. is probably all right, even if you keep food for a fairly long time. However Consumers Union prefers the extra margin of cold at 0°F.; the lower temperature gives more protection against fluctuations resulting from defrosting, opening doors and putting away relatively warm foods...." (35).

In the opinion of the Survey team, the function of a home freezer, in most cases, is to maintain temperatures of retail-purchased frozen food, not necessarily to freeze foods. As pointed out before, 0°F. is the desirable temperature and is considered by the industry to be its maximum and prime requisite for frozen food quality maintenance. An industrial source, #180FIS, stated in educational public relations literature issued for its institutional frozen foods:

"Frozen Foods deteriorate 6 TIMES as fast at plus 10 degrees (+10°F) as they do at zero degrees Fahrenheit (0°F.).

At (+20°F.) they deteriorate 36 TIMES as fast.

At (+30°F.) it is 216 TIMES as fast.

"Looking at it another way...

At (+10°F.) a frozen product deteriorates in TWO MONTHS as much as it will in a YEAR at zero degrees Fahrenheit.

At (+20°F.) a frozen product deteriorates in TEN DAYS as much as in a YEAR at zero degrees Fahrenheit.

At (+30°F.) a product deteriorates in 40 HOURS as much as in a YEAR at zero degrees Fahrenheit.

"Temperature damage CANNOT be corrected! Once damage occurs from too high a temperature, reducing the temperature in the freezer or holding compartment will NOT correct the damage.

"Damage to quality in frozen foods adds up.

"Mild damage accumulates. Damage may become severe through accumulations of mild damage, or from a single occasion of greater damage.

"It is NOT the highest temperature to which frozen foods have been subjected that determines the amount of damage. It is the TOTAL of high temperatures."

The foregoing statements are assumed to be derived from the scientific studies of the Western Utilization Research Laboratory, USDA. An analysis of the above data shows that, given a deterioration value rate of 0 at 0°F., the

rates grow exponentially; at 5°F., 2-1/2 times; at 10°F., 6 times; 20°F., 6²; 30°F., 6³; and so on.

A third reason for quality loss in the consumer phase relates to the significance of temperature cycling on frozen food quality and the fact that it is the most detrimental factor in quality loss. This factor is not promulgated by the industry to the supermarket; nor is it closely controlled by industry. Thus, the consumer is not protected.

The consumer aspects of home storage of frozen foods were studied in 2,844 families (34). The survey revealed that food items are stored in the home for different time intervals, depending on the type of freezing unit. Consumers with conventional refrigerators (32°F.) generally store frozen foods for less than 2 weeks. Sixty-five percent of the sample stored frozen foods in a combination freezer-refrigerator or in a separate freezer unit. The temperature of home freezer units ranged from -11 to +30°F.; refrigerators ranged from 5 to 30°F. (median 15°F.); separate freezer units from -11 to +10°F. (median 0°F.); and combination freezer refrigerators ranged from -10 to 25°F. (median 4°F.). Ten percent of the households stored frozen foods at 20°F., usually for less than 1 week. In 25 percent of the cases, the range was 11-25°F. Consumers responded in the survey to questions on purchase and using habits of frozen foods. Their replies are shown in table 12. The answers show that consumers are aware of both technical and aesthetic quality aspects of the purchased products and treat frozen foods with reasonable care.

Table 12.--Distribution of responses to questions about practices in buying and using frozen food

Question	Response				
	Yes		No		Total
	No.	Pct.	No.	Pct.	No.
After grocery shopping, do you feel that you need to hurry home to refrigerate the frozen foods you have bought?	1691	60	1130	40	2821
Do you sometimes refreeze thawed or partly thawed foods?	909	32	1900	68	2809
Would you buy a juice-stained package of frozen food?	148	5	2610	95	2758
Do you sometimes leave a package of frozen food to thaw at room temperature for more than 2 hours?	1806	64	1013	36	2819

--Continued

Table 12.--Distribution of responses to questions about practices in buying and using frozen food--Continued

Question	Response				
	Yes		No		Total
	No.	Pct.	No.	Pct.	No.
When buying groceries, do you select the frozen foods you want at the beginning of the trip through the store?	335	12	2445	88	2780
Would you buy a package of frozen food having a cut or torn wrapper if the food seemed solidly frozen?	472	17	2327	83	2799
When you buy frozen food, does the clerk place them together in a separate bag for you?	1740	62	1045	38	2785
If not, would you prefer that he do so?	1091	90	118	10	1209
When you have a partially used package of frozen food in your freezer, do you try to use it within a certain length of time?	1943	77	587	23	2530

Source: Hunt (34), in Research Bulletin 1010, Ohio Agriculture R&D Center Workshop.

2. Consumers in Foreign Countries--As shown in the Legal Report dealing with overseas food laws, some foreign governments place high priority on the need to provide clear consumer instructions on food packages. This is not confined to frozen foods alone. In the United Kingdom, frozen foods were introduced as convenience items a little later than in the United States. Previously, home preservation and freezing of frozen foods were not as widely practiced there as in the United States. Hence, the British consumer did not know how long foods could, or should, be safely stored in the home. The United Kingdom frozen food industry trade associations and refrigerator-freezer manufacturers cooperated to provide a unique system to alleviate consumers' concern in an educational manner, while providing them with a knowledge of recommended home storage life. The system was later incorporated by the Government as a British Standards Institution (BSI) standard for refrigerator manufacturers. The system is BSI No. 3739 (36), known as the Three-Star System.

The system endeavors to clearly define time and temperature of home storage protection for each type of refrigerator-freezer, or freezer unit, commonly available in the United Kingdom. It is independent of the nature of

the frozen food product.^{5/} If a freezer unit can maintain a temperature of 21°F., food should be used within a week; if 10°F. (-12°C.), within 1 month; and if 0°F. (-18°C.), within 3 months. The refrigerator-freezer or freezer units are rated on the basis of their ability to achieve such temperatures, and in consequence receive one (*), two (**), or three-star (***) ratings. The system, simple in concept, was instrumental in educating the British consumer on the very important time-temperature quality relationship of frozen foods. Note that when the data from the Hunt survey (34) (discussed above) are examined, the Three-Star System correlates rather well with the times of storage in common practice in randomly chosen households in the United States. There are notably no specific procedures whereby the British Government, or the producers, arrive at shelf-life times for frozen foods. The British Government considers this a prerogative of the manufacturer. In the specifications of the British Standards Institute Regulation (36), the British Government authorities are not suggesting that any frozen foods will keep for 1 week at -6°C.; 1 month at -12°C., or 3 months at -18°C., or that 3 months is the longest time for which frozen foods can be kept (37). The specifications simply provide the standard conditions ". . . for the design testing and classification of low-temperature compartments in freezers. . . ."

The United Kingdom source (37) also indicated the following about the Three-Star System:

"...The 'starred' system indicates, as a result of the food manufacturer's experience and testing procedure, how long a product can be expected to keep under the conditions concerned.

"If a consumer has purchased her refrigerator before the introduction of the 'starred' system there is nothing she can do except to ask the manufacturer how it is graded, and this information most manufacturers are prepared to supply.

"Non-U.K. firms exporting to the U.K. are not required to comply with these regulations but, in fact, they do so because European countries have introduced the same standards.

"The reaction of the Consumer Council to this type of protection has been most encouraging and thus very much welcomed...."

The Three-Star System has been generally adopted throughout Europe (Germany, Italy, Holland, Belgium). The deficiency of the system in ignoring temperature fluctuation in automatic defrosting is being examined to modify the British Standards Institution's specifications. The intent of the examination is to correct such fluctuations in some manner. The inability of the system to control temperatures in the food distribution system prior to sale may be considered a weakness (38). In reply to a question on this matter, a representative of BSI (39) stated:

^{5/} Ice cream products are the only noted exception to the 1-week, 1-month, 3-month rule, in which the times of specific storage temperatures are 1 day, 1 week, 1 month.

"Control is exercised over his own products by each frozen food manufacturer, at least as far as the stage of delivery to the retailer. The major frozen food producers are jealous of their reputation for quality and put considerable effort into organizing the distribution, checking quality at all stages, and into the education of the retailer...."

He further said that the star-marking system was well received by the British consumer. With respect to legislation in conjunction with the system, there is no legal requirement to use the star-marking system. However, this is covered by the Trade Descriptions Act of the United Kingdom, which allows legal proceedings by the Weights and Measures Authorities against false labeling or advertising claims. This system, if used in the United States, would probably be covered by the U.S. Fair Packaging and Labelling Acts of 1968.

The most popular freezer in the United Kingdom is the 2-Star type, i.e., one operating at 10°F. (-12°C.), which provides 1 month of storage. This would appear to correlate with U.S. freezer sales, except that in the case of U.S. freezers there has been no instruction by frozen food equipment manufacturers, frozen food manufacturers, trade associations, retail outlets, or home magazines as to capability of freezers or time of storage for frozen foods, which may unknowingly be stored longer than the United Kingdom recommendations. In the United Kingdom, the system was promulgated in one industry paper entitled, "Storage of Quick Frozen Foods in Household Refrigerators" (40), and also publicized to consumers in the British press, radio, television, women's magazines, and various journals.

Home Care of Purchased Frozen Foods is the title of a USDA publication (19) which stresses storage temperatures of 0°F., in a freezer separated from the refrigerator or in a totally separate freezer; purchasing methods; and general home-handling methods. The following tabulation from the publication suggests maximum home storage periods to maintain good quality in commercially frozen foods.

"Suggested Maximum Home-Storage Periods to Maintain Good
Quality in Commercially Frozen Foods"

<u>Food</u>	<u>Approximate Holding Period at 0°F. Months</u>
<u>Fruits and vegetables</u>	
Fruits:	
Cherries	12
Peaches	12
Raspberries	12
Strawberries	12
Fruit juice concentrates:	
Apple	12
Grape	12
Orange	12

<u>Food</u>	Approximate Holding Period at 0°F. <hr/> Months
<u>Fruit and vegetables--Continued</u>	
Vegetables:	
Asparagus	8
Beans	8
Cauliflower	8
Corn	8
Peas	8
Spinach	8
<u>Baked goods</u>	
Bread and yeast rolls:	
White bread	3
Cinnamon rolls	2
Plain rolls	3
Cakes:	
Angel	2
Chiffon	2
Chocolate layer	4
Fruit	12
Pound	6
Yellow	6
Danish pastry	3
Doughnuts:	
Cake type	3
Yeast raised	3
Pies (unbaked):	
Apple	8
Boysenberry	8
Cherry	8
Peach	8
<u>Meat</u>	
Beef:	
Hamburger or chipped (thin) steaks	3
Roasts	12
Steaks	12
Lamb:	
Patties (ground meat)	3
Roasts	12
Pork, cured	2

<u>Food</u>	Approximate Holding Period at 0°F.
<u>Meat</u> --Continued	Months
Pork, fresh:	
Chops	4
Roasts	8
Sausage	2
Veal:	
Cutlets, chops	4
Roasts	8
Cooked meat:	
Meat dinners	3
Meat pie	3
Swiss steak	3
<u>Poultry</u>	
Chicken:	
Cut-up	9
Livers	3
Whole	12
Duck, whole	6
Goose, whole	6
Turkey:	
Cut-up	6
Whole	12
Cooked chicken and turkey:	
Chicken or turkey dinners (sliced meat and gravy)	6
Chicken or turkey pies	12
Fried chicken	4
Fried chicken dinners	4
<u>Fish and shellfish</u>	
Fish:	
Fillets:	
Cod, flounder, haddock, halibut, pollack	6
Mullet, ocean perch, sea trout, striped bass	3
Pacific Ocean perch	2
Salmon steaks	2
Sea trout, dressed	3
Striped bass, dressed	3
Whiting, drawn	4

<u>Food</u>	Approximate Holding Period at 0°F. <hr/> Months
<u>Fish and shellfish--Continued</u>	
Shellfish:	
Clams, shucked	3
Crabmeat:	
Dungeness	3
King	10
Oysters, shucked	4
Shrimp	12
Cooked fish and shellfish:	
Fish with cheese sauce	3
Fish with lemon butter sauce	3
Fried fish dinner	3
Fried fish sticks, scallops, or shrimp	3
Shrimp creole	3
Tuna pie	3
<u>Frozen desserts</u>	
Ice cream	1
Sherbet	1

The National Association of Frozen Food Packers (NAFFP) (5), a U.S. trade association now known as the American Frozen Food Institute, has extensive publications on frozen food and distributes information on methods of quality maintenance to its members and other interested groups.

Distinct differences are to be noted in the recommended storage times under the generalized principles of the Three-Star System of the United Kingdom and other shelf-life times presented above and in section VIII. The United Kingdom system is, however, valid. It has a scientific basis, and realistically considers temperature fluctuations in everyday trade, home handling, care, and use in the United Kingdom. It deserves critical scientific evaluation by the U.S. frozen food industry for its situation.

VII. PRESENT PRACTICES OF CODE DATING/PUBLIC DATING

A. Voluntary Food Industry Code Dating and Monitoring

Voluntary industrial code dating practices aid in the policing of products throughout manufacturing, distribution, and sometimes sales. The codes are usually of the alphabetic/numeric type, each company establishing its own system. Shelf lives of foods are based on extensive product and package testing, designed to simulate the worst practices, rather than ideal conditions (see VI. B. above).

B. Legal or Required Dating

1. Federal--The only required Federal code dating existing in the United States is that recommended in the "Good Manufacturing Practices" of the FDA noted in the Federal Register:

"Meaningful coding of products sold or otherwise distributed from a manufacturing, processing, packing or repacking activity should be utilized to enable positive lot identification to facilitate, where necessary, the segregation of specified food lots that may have become contaminated or otherwise unfit for their intended use. Records should be retained for a period of time that exceeds the shelf life of the product, except that they need not be retained more than 2 years."

For large companies, compliance with this suggestion was presumably redundant since it had been practiced for years, with accompanying policing.

2. State--Some States, such as Nebraska, North Dakota, Oregon, and Arkansas, have considered the introduction of public dating of frozen foods. However, it never became law for various reasons, among them the economic loss to food exporters and importers of particular States, and the impossibility of establishing the date of ingredients stored individually for later mixing with other ingredients, e.g., frozen fruit pies where fruits are harvested at one time and dough is manufactured at another. The main group arguing against such legislation was NAFFP, in conjunction with frozen food companies. Those in favor of such legislation were not identified as industry proponents. The factual reasons for the impracticalities of public dating, the dangers of public dating, the lack of conformity of temperature ranges of consumer freezers, and the impracticality of laws without enforcement were never considered.

Some sources state that most States which have adopted the AFDOUS code do not necessarily enforce or police it for various reasons, ranging from lack of enforcement funds to lack of interest. Such States were not directly identified.

The State of Maryland enforces a law requiring 0°F. for retail store storage by surveillance of temperatures at the retail store level. This is a step in the right direction.

Complete information on State legal requirements is provided in the Legal Report. The following States have frozen food requirements which necessitate some form of dating:

Arkansas: Code date

Connecticut: Permanently legible code marks, i.e., date of packaging on each container or package

Florida: Frozen shell fish, date or code of packing;
crustacea meat packed for freezing, date or code
of packing

Massachusetts: Fish for freezing, date of receipt; containers of lobsters for freezing, date of processing

Mississippi: Frozen food locker products, stamped with date of wrapping

New Mexico: Frozen food locker products, stamped with date of wrapping

Missouri: Frozen food locker products, inspected, wrapped, stamped with date of wrapping

Pennsylvania: Permanently legible code, date of packing

South Dakota: Frozen meat, date of wrapping and type of freezing.

The following States have dating requirements for cold storage (cold storage temperatures were not defined):

Arizona	Ohio
Delaware	Nebraska
Hawaii	New Hampshire
Indiana	New Jersey
Maryland	Virginia
Minnesota	Washington.

The following States have adopted the AFDOUS Frozen Food Code, either partial or complete:

Arkansas	Illinois
Connecticut	Massachusetts
Florida	Maryland
Georgia	Oregon

Pennsylvania.

Other States are using the codes as an administrative guide in setting State food and drug standards (41).

3. Municipal--No municipal requirements were found, except for sanitation of food retail plans and stores, e.g., New York City Health Codes.

4. Foreign

a. Austria: Dating is established on a basis similar to Germany's, described below.

b. Finland: Dating is now established on a voluntary basis, and proposed legislation in the future is to be considered based on a study by a consumer group in that country commencing in the fall of 1969. Certain dairy products have mandatory dating and a controlled shelf life.

- c. Germany: The pre-World War II German Ordinance of May 8, 1935, concerning the external handling of food, includes a time of filling by date and year, and also a listing of various foods included under the ordinance. General amendments within this law forced West Germany to amend the Food Labelling Law of September 9, 1966, to date the regulation food types. Date of production could be altered to date of packaging and filling. This requirement can be omitted if the "time to which the product is usable, by day, year and month" for certain products is specified. Such directions are not required for "products which are deep frozen and designated as such."

Amendments were made in 1968 (January 1) from which relevant statements for frozen foods are listed below. A complete abstract of the Declaration of 1968 is included in the Legal Report, appendix 1.

"...for stored items, preserves, and frozen foods, these should be the designations of the month and year..."

"1. Refrigeration

(From production date, storage at least - 18°C. (sic 0°F.)

Months

a) In the Deep Freezer

Beef	nine to twelve
Pork	four to six
Poultry	seven to twelve
Lean fish	three to six
Fatty fish	two to three

b) Evaporated cooler - 12°C. (sic 10°F.)

Beef	two to three
Pork	one to two
Poultry	one to two

c) Refrigerator (to +5°C.) (sic 23.0°F.)

Fish, crabs, and chopped meat	six to eight hours
Leftovers	twenty-four hours"

- d. Norway: A "use before..." type of statement is defined for easily perishable items, defined as products which have: (1) pH more than 4.5, and (b) level of "H₂O activity" more than 0.9. Some frozen foods may be included in this definition.

- e. Sweden: While Sweden considers requirements for public durability dating (i.e., expiry dating) of foods of a perishable and semiperishable nature (meats, fruits,

vegetables, luncheon meats), it believes frozen and canned foods are stable and do not require durability dating practices.

- f. United Kingdom: The British Three-Star System is explained in a publication of the British Standards Institution, BSI No. 3739 (36). Because of their relevance to this research, salient points of the BSI specification are quoted as follows:

"British Standard Specification for
FROZEN FOOD STORAGE
COMPARTMENTS IN REFRIGERATORS
For Household Use

"This British Standard, having been approved by the Refrigeration Industry Standards Committee and endorsed by the Chairman of the Engineering Divisional Council, was published under the authority of the General Council on 6th April, 1964.

"The Institution desires to call attention to the fact that this British Standard does not purport to include all the necessary provisions of a contract.

"In order to keep abreast of progress in the industries concerned, British Standards are subject to periodical review. Suggestions for improvements will be recorded and in due course brought to the notice of the committees charged with the revision of the standards to which they refer....

"This British Standard applies to low temperature compartments, to be embodied in household refrigerators and intended for the storage of frozen foods for varying periods of time. Such compartments are supplementary to the general compartment specifically arranged for the storage of unfrozen food.

"A household refrigerator may include one or more compartments of any of the three classes specified in this standard.

"...Three classes of compartment are specified, and are designated ONE-STAR, TWO-STAR and THREE-STAR compartments. They are rated according to the following basic temperatures to be attained when they are tested in accordance with the methods described in Clause 4.

"One-star compartment. Basic test temperature -6°C . (21.2°F .)
Two-star compartment. Basic test temperature -12°C . (10.4°F .)
Three-star compartment. Basic test temperature -18°C . (-0.4°F .)...

"The permissible length of storage time implied by this classification cannot be precisely stated, as the time varies very much with the nature of the frozen food stored - vegetables, fish, meat, fruit, dairy products, etc. It is therefore important to take note of the frozen food manufacturer's estimate of the permissible storage time for his products when

kept in the one-, two-, or three-star compartments. This estimate, which should be marked on each frozen food package, takes into account inevitable variations during everyday operation which may lead to loss of flavor, taste or color.

"The frozen food manufacturers' estimates should always be obeyed. As a rough guide, however, average permissible storage times expected with careful operation to the refrigerator manufacturers' instructions are:

In a one-star compartment for short-term storage, 1 week.

In a two-star compartment for medium-term storage, 1 month.

In a three-star compartment for long-term storage, 3 months....

Marking

"The classification of a frozen food storage compartment shall be indicated by the appropriate number of six-pointed asterisks in a frame with curved sides.... It shall be applied to each frozen food compartment provided....

"There shall be no marking or decoration anywhere on the refrigerator that can be confused with the star marking...."

The specification describes the test conditions, ambient conditions, loading of the freezer compartment with model packages of frozen food (saw-dust in water), and location of thermocouples in the samples. Special consumer instructions to be issued with each unit describing the principles and the Three-Star System follow:

"INSTRUCTIONS FOR USE

"The instructions supplied with the refrigerator shall include the following:

- "a. An indication of the thermostat setting necessary to obtain the prescribed temperature in the frozen food compartment.
- b. An explanation that the temperatures within the various compartments are affected by such factors as the location of the refrigerator, the ambient temperature, and frequency of door opening. A warning should be given that the thermostat setting might have to be varied to allow for these factors.
- c. A warning that it is necessary to store frozen food in accordance with the frozen food manufacturers' instructions. This warning must include the substance of the following:

A ONE-STAR compartment is intended for the SHORT-TERM storage,
A TWO-STAR compartment is intended for the MEDIUM-TERM storage,
A THREE-STAR compartment is intended for the LONG-TERM storage
of frozen food.

"It should be noted that the permissible length of storage time implied by the terms short-term, medium-term and long-term cannot be precisely stated as this varies very much with the nature of the packaged frozen food. It is therefore important to take note of the frozen food manufacturers' estimate of the permissible storage time.

"The maximum permissible storage time in One-star, Two-star, and Three-star compartments will usually be marked on the frozen food package, and this should not be exceeded. Generally speaking, as a guide, short-term storage may be taken to be 1 week, medium-term, 1 month and long-term up to 3 months.

- d. Precautions necessary to prevent undue rise in the temperature of the frozen food while defrosting the refrigerator such as wrapping the frozen food packets in several thicknesses of newspaper.
- e. An explanation that a rise of temperature of the frozen food packs during defrosting may shorten the storage life and that the estimate given above and in Note 1 of Clause 2 may not then apply...."

C. How Dating Influences Quality Maintenance: Advantages and Disadvantages of Dating

1. Voluntary dating by industry--Quality retention is based on the maintenance of low temperatures (0°F. or below) of the stored product, good manufacturing practices in selection of raw materials; sanitary, high-speed handling and processing of the products; and a surveillance of every step of the product throughout its life cycle "from seed to consumer." The presently used cryptic code dating permits a frozen food company to distribute a blended, standard quality product on an equitable distribution basis, without price increases in the rare instances of poor crop season caused by inclement weather. Code dating of frozen foods as now practiced does not directly influence quality maintenance in any way; however, it gives the manufacturer a tool to identify his batches of products.

Public dating is usually not applied; if it were, it could detrimentally influence aesthetic quality. An exception is the consumer who owns the type of freezers that run at 0°F. (-18°C.) in his home. Dating bears no relationship to prevention of cooking errors. It would not prevent the possible loss of nutritional quality which occurs in the use of excessive amounts of cooking water in preparation.

Required public dating, except for warehouse storage in some stores, is not practiced in the United States (all references below are to foreign countries). Its quality-promoting effects are only known for England. British replies indicate that the consumer is pleased because dating gives her the means of telling how and for how long to store frozen foods, based on the category of her refrigerator/freezer. An assumption can be made that the Three-Star Dating System is the best rationalization that can or could be practically

made. The suggested retail store stamping of date of shelf display could aid consumer stock rotation. Guidance on how long to store foods by association with styles of refrigerator/freezer, as noted on the suggested "in-store" placard scheme, could be interconnected through the date of shelf marking.

2. Trade Association--Position of the National Association of Frozen Food Packers, now known as American Frozen Food Institute,^{6/} is as follows:

"PROPOSED RESOLUTION OF THE BOARD OF DIRECTORS
Association Policy on Frozen Food Date Labeling

"The National Association of Frozen Food Packers has carefully considered the matter of labeling of frozen food packages with the date of packing in light of the interest of high standards of quality for which the industry strives.

"The Commissioner of Food and Drugs and the Administrator of Consumer and Marketing Service, USDA, have not considered it desirable, in the interest of consumers, to include the date of packing on the labels of frozen food packages.

"The NAFFP encourages code dating of frozen food packages.

"The NAFFP has consistently and vigorously opposed all legislative proposals which would require the date of packing to appear on labels of frozen food packages.

"In order to establish guidelines for committees and staff of the Association on the matter of requiring the date of pack on the labels of frozen food packages, the Board of Directors adopts the following:

"Resolution:

1. It is a well established scientific fact that the quality of frozen products is dependent upon several factors, among which the most important are the initial quality of the raw material and the integrated effect of the length of time of storage and the storage temperature. Reference is made to "Quality and Stability in Frozen Food" edited by Michael J. Copley, W. B. Van Arsdale and Robert L. Olson, all of the Western Utilization Research and Development Laboratory, ARS of USDA. The publisher is Wiley-Interscience, 605 Third Avenue, New York, New York 10016.

2. It is also well known that quality changes during storage differ widely for different products, depending upon their basic characteristics. Some vegetable products have high quality lives at 0°F. for up to three years, whereas other products, such as fatty fish species, have a high quality life of only a few months at the same temperature.

^{6/} See end of this chapter for "Code of Recommended Practices of the Frozen Food All-Industry Coordinating Committee."

3. Historically, a common concept of food date labeling has been related to the term "fresh," as in the case of bread, eggs or milk. However, the term "fresh" relative to its application to frozen food has been considered ambiguous and, therefore, undesirable by the Food and Drug Administration and the United States Department of Agriculture.

4. Since dating would be considered by consumers to be a means of selecting high quality, but in fact is an unreliable index, it would cause confusion and economic waste.

5. Under usual conditions of handling frozen food, an "older" product which has been well handled will be superior in quality to a recently frozen product which has been badly handled.

6. Furthermore, the use of various forms of indicators has been suggested to insure an objective "measurement" of storage temperatures or time/temperature effects. So far, all such indicators tested fall far short of their objective because they reflect quality changes which studies show do not occur. Stability tests of frozen food show that, even a few exposures of higher temperatures (e.g. 10°F. to 20°F.) although generally undesirable, cause little or no detectable change in quality. Reference is made to NAFFP's Technical Service Bulletin No. 51, "A White Paper Report on The Minneapolis-Honeywell Device." The use of such devices could not by itself provide any guarantee to the consumer that the product is of a satisfactory quality at the time of final sale. In fact, this practice could be most misleading."

VIII. FOOD PRODUCT ITEM LIST--SHELF LIFE

A. Shelf Life--Food Industry Sources (FIS)

<u>Food item</u>	<u>Time</u>	<u>FIS No.</u>
Frozen foods (general)	210D	520
Frozen foods (general)	1Y	165
Frozen foods (general)	Several years	460
Frozen foods (general)	Indefinite	
	before defrosting	719
Fish	4-5M	30
Dinners	6M	30
Institutional	6-24M	820
Institutional	1Y	165
King crab	12M	30
Lobster	3M	30
Flounder	14-16M	30
Haddock	10-11M	30
Cod	10-11M	30

Y = year; M = month, D = days.

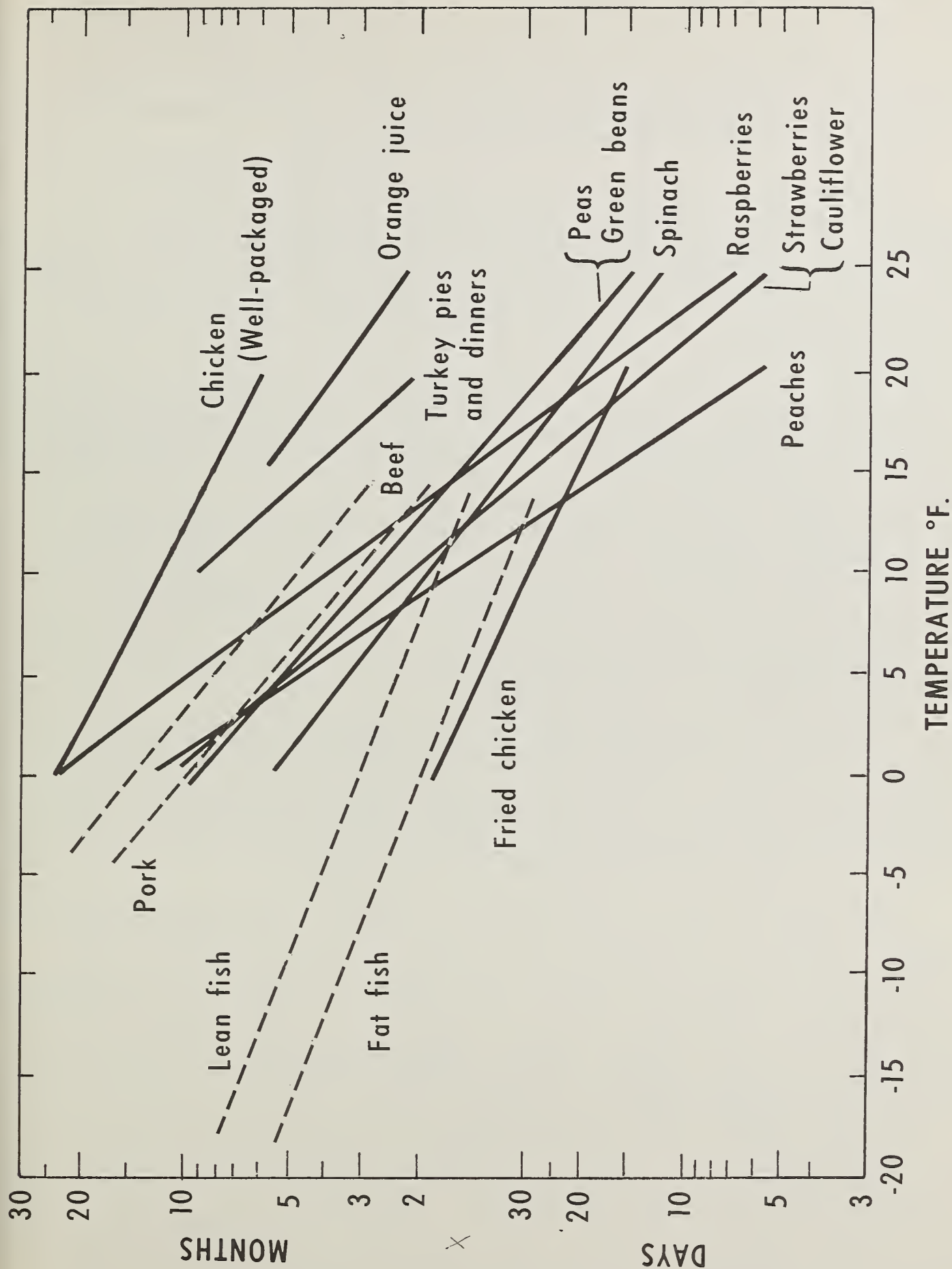


Figure 6.--Relative stabilities of frozen foods
Source: Allan D. Shepherd (42).

B. Shelf Life--Scientific Source

The shelf life of selected frozen foods, on a scientific basis, is shown in fig. 6. In connection with this information, which was compiled by A. D. Shepherd (42) from research data from the USDA Western Utilization Research Laboratory, the following statements from Dr. R. Olson of that Laboratory are relevant (Frozen Food Executive Bulletin, March 20, 1970):

"'Stable life' is a term for the subjective statistical measurement we have called by a number of terms, including 'just noticeable difference,' 'just perceptible difference' and 'high quality life.' I was pleased to see that you carefully defined the term as we have always been careful to do. Nevertheless, whatever term is used, the concept is frequently misunderstood. I would like to provide a further statement about this concept.

"The 'just perceptible difference' is the time interval over which sufficient change in quality attributes occur to enable a trained panel, under ideal testing conditions, to significantly identify a difference between a sample stored under test conditions and another sample of the same lot which has been protected from change. The common mistake is to infer that this truly insignificant change in quality has some fixed relationship to a terminal date for marketing products. 'High quality life' (our term at times), 'stable life' (your term), 'useful commercial life' are terms that we now think have an unfortunate connotation, a limitation of good quality and food value. We now prefer 'just perceptible differences,' which more clearly matches the actual parameter--a value of quality change not of absolute quality.

"I hope your readers will not, as others have, try to interpret our published data as the maximum length of storage for the particular commodities listed. Freezing is still the best method for preserving fresh quality of foods. For many products, excellent quality and high levels of consumer acceptability are retained for storage many times longer than that to the just perceptible difference.

"The quality values of foods cannot be measured absolutely by the length of time in the freezer or the temperature at which they have been held. The temperature influences the rate of change in quality. The storage time is directly related to the amount of change at a temperature. Initial quality and rate of quality change are variables between products and between lots of a given product. Generally speaking, only examination of product, not the duration of its storage or temperature, can be used to determine product quality.

"We advocate 0°F. storage -- lower for the more sensitive products -- as a goal to strive for. At the same time we recognize realities in commerce that prevent 100% achievement. The data we have published should help industry decide the hard issues of product quality against cost of operations. We believe that in close competition product quality will provide the leverage for continuing success. Thus far the frozen food industry has thrived on a reputation of high-quality products. It is to

the self-interest of industry to preserve that reputation by packing high-quality products and preventing their deterioration in distribution and marketing channels."

IX. RECOMMENDATIONS ON BEST MEANS OF FOOD QUALITY MAINTENANCE

A. Through Dating/Coding

Frozen food companies generally practice industrial coding on packages. One major company (#360FIS) openly dates its exterior cases of frozen food containing individual packages with the date of final packaging. Ideally, this practice should become common trade procedure. It would promote fundamental, good food business procedures and would promote first-in, first-out stock rotation for retailer inventory control. In addition, there should be distinguishable, legible-to-the-trade date codes on individual packages for the purpose of withdrawal of complaint lots, at the processor's discretion. These codes should be in addition to any which might be needed for the processor's own needs. For example:

	Month/Day/Year	
Case/carton dating--	Oct. 15, 1963	+ shift number
		plant location
Package codes--	10-15-63	grade, etc.
	101563	

Carton dating should relate to the date of final packaging of the individual packages, regardless of the age of the product ingredients. The use of ingredients processed at earlier times and kept in storage for later use, as in the case of prepared foods, prompts this statement. Presumably, frozen food producers will maintain normal good practices in this respect. It is also recognized that shelf-life testing should be based on the testing of the collective final product and its package rather than on the testing of the separate individual components. Date of final packaging is recommended because it is intended to serve only one purpose--to permit, encourage, and allow first-in, first-out stock rotation in the channels of distribution and retail store operations.

Other coding can be any symbols that manufacturers find useful for their purposes.

The alternative of code dating is public dating. This term implies any form of dating that the consumer understands. Public dating of frozen foods by manufacturers is distinctly not recommended. Such dating is not beneficial because it makes no provision for indicating the home storage temperature requirement, which is the most important factor in controlling the quality of frozen foods.

Home Storage Freezers

There are three types of frozen food freezer storage units in consumers' homes (2). These operate at three different temperatures, as follows:

Type	Temperature		Style
	°C.	°F.	
A	- 6	21.2	Hanger
B	-12	10.4	Freezer across top within main refrigerator
C	-18	-0.4	Separate freezing compartment with food freezer

Type A is an old style refrigerator with a "hanging box" freezer section at the top. Type B has a frozen food storage area isolated from the rest of the refrigerator, usually by an insulated "plastic door within the main door." Type C is either the modern refrigerator with a "separate freezer" compartment separated from the main refrigerator by a different entrance door, or "totally separate (home) freezer" units. These units operate at different temperatures whose ranges were noted above in section VI D.

The effect of storage temperature on quality was noted in section VI C and illustrated in figure 6 above, which shows that the rate of deterioration increases rapidly as food temperature rises. Storage temperature and quality cannot be separated and must be considered in relation to each other. Hence, it is recommended that these two quantitative dimensions be integrated and systems be established to provide the consumer with knowledge of time-temperature quality dependence of frozen food storage. Three possibilities seem feasible to implement this recommendation; each has advantages and disadvantages and places responsibility in a different location.

The first possibility is the development of low-cost, time-temperature indicators for location on or within the unit consumer and retail case packages. Such a device was developed in the early 1960's by the Honeywell Corporation but proved too expensive for its intended application. However, there have been recent suggestions of technological breakthroughs in this area.

The second is a retail store level operation involving the use of placards, with photographs, located in frozen food sales areas. The cost would be shared by food industry companies, associations, and retail stores. The placards would illustrate various styles of home storage units and provide recommended times of home storage in each style. This program would be less expensive to implement and less time consuming to introduce than the third alternative.

The third alternative is adoption of the British Standards Institution's Three-Star Dating System by the frozen food industry and refrigerator-freezer manufacturers. The Three-Star System classifies freezers into categories A, B, and C--one star (*), two stars (**), and three stars (***), respectively. Packages would be marked with this star scheme. The permissible storage times for all frozen foods proposed by the British system are as follows:

	Ice cream (sole exception)	
*	1 week	1 day
**	1 month	1 week
***	3 months	1 month

Figure 7 depicts a typical United Kingdom ice cream package and demonstrates how the Three-Star System is applied as a package label. The implementation of the system in the United States would be very expensive.

In New Jersey, the Department of Health could assume the responsibility of arranging for the design and display of suggested placards in retail store frozen food outlets as part of its consumer information activities. If the department sponsored the project, the chances of reasonably quick implementation would be enhanced.

B. Other Means of Quality Improvement

The State of New Jersey, in conjunction with other States, should consider the legal adoption of the AFDOUS (Association of Food and Drug Officials of the United States) Frozen Food Code of 1962 and the Code of Recommended Practices for the Handling of Frozen Food issued in 1970 by the Frozen Food Coordinating Committee. To be effective, the measures would require a commitment to inspection and enforcement services by the New Jersey Department of Health. The food industry should also continue its voluntary monitoring programs and apply and follow the recommended practices of the National Association of Frozen Food Processors (NAFFP), the AFDOUS Frozen Food Code, the 1970 Code by the Frozen Food Coordinating Committee, or improvements of these.

While it would be a good beginning to follow the practice of AFDOUS and other frozen food handling recommendations, New Jersey should also consider code dating of packages and open dating of cases or containers of frozen foods.

Companies in the channels of distribution, e.g., warehousing and transportation companies and associations, should increase surveillance (as recommended by AFDOUS and NAFFP) and consider the installation of time-temperature recorders, with warning devices for temperatures above 0°F. Retail stores that normally price stamp their products prior to display also should stamp the date of shelf display on the products to assist stock rotation, especially in the consumer's home. This information, combined with designation of time for home storage, gives the consumer an approximate date for the starting time of storage in the home and consequent use of the product.

Of paramount importance is the checking of temperatures of incoming frozen food shipments by distribution personnel and retail operators. This practice is recommended by ASHRAE, AFDOUS, and NAFFP.

Retail stores should consider the installation of horizontal air-curtained or vertical door freezer cabinets. Stores should fit nonair-curtained open-top freezers with plastic roll top covers for overnight temperature control. (The supermarket freezer is not designed to freeze products, but rather to maintain them at 0°F. or below.) The vertical door units might possibly be fitted with front (display) and rear (stock room) opening doors to permit loading from the back and the consequent introduction of automatic stock rotation. These measures could be accommodated by close liaison among refrigerator manufacturers, retailers, and the food industry.



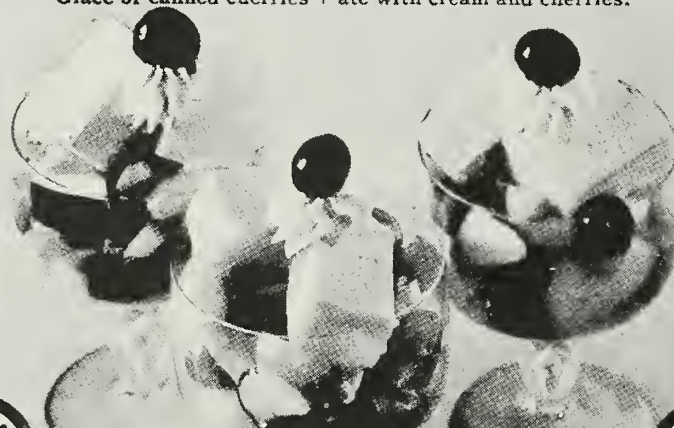
CORNISH

DAIRY ICE CREAM

A delicious sweet – complete in itself. Or try...

COUPE JACQUES

Canned or fresh fruit salad Cornish Dairy Ice Cream Whipped Cream Glacé or canned cherries	Divide the fruit salad into individual glasses. Cut the ice cream into cubes as shown and place on top of the fruit. Decorate with cream and cherries.
---	--



Now try these other Cornish ice cream sweets

**CORNISH CHOCOLATE RIPPLE
CORNISH AND STRAWBERRY FAYRE**

**INGREDIENTS: DAIRY ICE CREAM
MINIMUM CONTENTS 17 fl. oz. (483 ml.)**

If your frozen food compartment has the new 'star' marking, here are the recommended storage times:

★ 1 day **★★** 1 week **★★★** 1 month

Figure 7.--Illustration of British Three-Star notation

Source: T. Wall & Sons, Ltd. (37). Note that trade names are used in this report solely for providing specific information. Mention of a trade name does not mean a guarantee or warranty of the product by the survey team or an endorsement by the Department of Food Science, Rutgers University.

Store traffic should be designed to assure frozen food pickup as a last item on a shopper's list. It would also be helpful to provide insulated frozen food bags in locations convenient to the freezer cabinets so that consumers can better protect their frozen food in the interval between store pickup and home storage or use.

X. REFERENCES

- (1) Chain Store Age, 1969 Supermarket Sales Manual, Lebhar-Friedman, Inc., New York, N.Y., July 1969.
- (2) U.S. Department of Agriculture, "Conference on Frozen Food Quality," Albany, Calif., November 1960
- (3) New Jersey Department of Health, Retail Food Establishment Code of New Jersey 1965--F-D18, August 1968.
- (4) AFDOUS--Association of Food and Drug Officials of the United States, "Frozen Food Code," adopted June 22, 1961, Washington, D.C.
- (5) NAFFP--National Association of Frozen Food Packers, Washington, D.C., now known as American Frozen Food Institute.
- (6) ASHRAE--American Society of Heating, Refrigerating, and Air-Conditioning Engineers, 343 East 47th Street, New York, N.Y.
- (7) Potter, N. N., Food Science, The Avi Publishing Company, Westport, Conn., 1968.
- (8) Hanson, H. L., and Fletcher, L. R., Time-Temperature Tolerance of Frozen Foods, XII, "Turkey Dinners and Turkey Pie," Food Technology, 1959, pp. 40-43.
- (9) Harrison, D. L., Vail, F. E., and Kalen, J., "Precooked Frozen Stews and Swiss Steak," Food Technology, 1953, pp. 139-142.
- (10) Lane, J. P., Time-Temperature Tolerance of Frozen Foods, I, "Review of Some of the Recent Literature on the Storage Life of Frozen Food Products," Food Technology, Vol. 18, p. 1100.
- (11) U.S. Department of the Interior, Bureau of Commercial Fisheries, Preparation, Freezing, and Cold Storage of Fish, Shellfish, and Precooked Fishery Products, Fishery Leaflet No. 430, Washington, D.C., 1963.
- (12) Harris, R. S., and von Loesecke, H. (eds.), Nutritional Evaluation of Food Processing, John Wiley and Sons, Inc., New York, N.Y., 1960.
- (13) Martinson, C. S., and Carlin, A. F., "Rate of Heating During Precooking in Foil and Quality of Boneless Turkey Roasts at 0°F.," Food Technology, Vol. 22, 1968, pp. 109-112.

- (14) Van Arsdel, W. B., Copley, M. J., and Olson, R. L., Quality and Stability of Frozen Foods, John Wiley and Sons, Inc., New York, N.Y., 1970.
- (15) Wenzel, F. W., et al., "Comparison of Color and Flavor in Frozen Concentrated Orange Juice," Proceedings of Florida State Horticulture Society, Vol. 71, October 1958, pp. 274-278.
- (16) Murdock, D. J., and Brokaw, C. H., "Spoilage Developing in 6-oz. Cans of Frozen Concentrated Orange Juice During Storage at Room Temperature and at 40°F. With Particular Reference to Microflora Present," Food Technology, No. 4, 1965, pp. 234-238.
- (17) Huggart, R. L., Harman, D. A., and Moore, E. L., "Ascorbic Acid Retention in Frozen Concentrated Citrus Juices," J. Am. Dietetic Assoc., Vol. 30, No. 7, July 1954, pp. 682-684.
- (18) International Institute of Refrigeration, "Recommendations for the Processing and Handling of Frozen Foods," Annex au Bulletin de L'Institut International du Froid, 177, Boulevard Malesherbes, Paris (17e), France, 1964.
- (19) U.S. Department of Agriculture, Home Care of Purchased Frozen Foods, Bulletin No. 69, U.S. Government Printing Office, Washington, D.C., September 1967.
- (20) Tressler, D. K., Van Arsdel, W. B., and Copley, M. J., "Freezing Preservation of Foods," Vol. IV, Freezing of Precooked and Prepared Foods, The Avi Publishing Company, Westport, Conn., 1968.
- (21) U.S. Department of the Interior, Bureau of Commercial Fisheries, Factors to be Considered in the Freezing and Cold Storage of Fishery Products, Fish and Wildlife Leaflet No. 429, Washington, D.C., 1967.
- (22) Guadagni, D. G., Nimmo, C. C., and Jansen, E. F., Time-Temperature Tolerance of Frozen Foods, XI, "Retail Packs of Frozen Sour-Pitted Cherries," Food Technology, Vol. 12, No. 1, 1958, pp. 36-40.
- (23) U.S. Departments of the Army, Navy, and Air Force, the U.S. Marine Corps, and the Defense Supply Agency, Storage and Materials Handling 1955, TM 743-200, rev., August 1968, Chap. 5, "Storage of Special Commodities."
- (24) Mecchi, et al., Poultry Science, Vol. 35, 1956, p. 1238.
- (25) National Fisheries Institute, Inc., Recommended Voluntary Operating Practices for the Handling of Consumer Packaged Frozen Foods, undated (1960?).
- (26) Canadian Frozen Food Processors Association, Distribution Practices of Frozen Foods, Ottawa, Canada, undated.
- (27) National Association of Frozen Food Producers, London, England.

- (28) "Microbiological Examination of Precooked Frozen Foods," AFDOUS Quarterly Bulletin Supplemental Issue, 1966.
- (29) "Recommended Bacterial Limits for Frozen Precooked Beef and Chicken Pot Pies," AFDOUS Quarterly Bulletin Supplemental Issue, 1969.
- (30) Hall, L. P., A Manual of Methods for the Bacteriological Examination of Frozen Foods, Fruit and Vegetable Preservation Research Assoc., Chipping Campden, Gloucestershire, March 1968.
- (31) Lundquist, A. L., Improved Handling Methods and Layout in Affiliated Frozen Food Warehouses, MRR No. 823, Agr. Res. Serv., U.S. Department of Agriculture, Washington, D.C., February 1969.
- (32) Sawyer, F. M. Midura, T. F., and Vondell, R. M., Handling and Merchandising Frozen Food, Cooperative Extension Service, University of Massachusetts, Amherst, November 1960.
- (33) Olson, R. L., and Dietrich, W. C., The Dimensions of Frozen Food Quality and Effects of Processing and Handling Practices, 1969.
- (34) Hunt, F. E., Practices in Handling and Storing Commercially Frozen Food in Ohio Households, Research Bulletin 1010, Ohio Agriculture R&D Center Workshop, May 1968.
- (35) Consumer Reports, "No-Frost Top Freezer Refrigerators," 496, September 1969; "No-Frost Side-by-Side Refrigerator Freezers," 573, October 1969, Mount Vernon, N.Y.
- (36) British Standards Institution, Specification for Frozen Food Storage Compartments in Refrigerators for Household Use, B.S. No. 3739, 1964.
- (37) Personal communication, M. G. John; T. Wall & Sons Ltd., The Friary, Acton W.3., England, September 1969.
- (38) Personal communication, M. S. Ware; Birds Eye Foods, Ltd., Station Avenue, Walton-on-Thames, Surrey, England, October 1969.
- (39) Personal communication, J. Brown, British Standards Institution, British Standards House, 2 Park Street, London, W. 1, England, September 1969.
- (40) Ware, M. S., "Storage of Quick Frozen Foods in Household Refrigerators," Star Marking of Frozen Food Packs and Frozen Food Compartments, Birds Eye Foods, Ltd., Station Avenue, Walton-on-Thames, Surrey, England.
- (41) Personal communication, editor of Canners Almanac, 79 Bond Street, Westminster, Md., October/November 1969.
- (42) Shepherd, Allan D., in report presented at a meeting on "Frozen Food Quality," USDA Western Regional Research Laboratory, Albany, Calif., November 4, 1960.

- (43) Elliot, R. P., and Michener, H. D., "Review of the Microbiology of Frozen Foods," Conference on Frozen Food Quality, Western Utilization Research Laboratory, U.S. Department of Agriculture, November 1960.

XI. REPORT REVIEW AND COMMENTS

A spokesman for an industry association (#80FIS) stated:

"...I do not support the theory that open dating of cases, cartons, etc. would facilitate stock rotation. You may be assuming that it would be possible to move a lot through all channels of distribution without being scrambled with other lots. The principle of 'first in first out' is good but the responsibility for the procedure and the identification for carrying it out should rest with the particular party responsible such as the warehouse, retail store or consumer's refrigerator...I don't believe open dating a retail package to insure stock rotation would work. In fact, wouldn't it work 'first in last out'...."

* * * * *

An expert stated,

"...Date and final packaging doesn't guarantee anything related to frozen food quality...frozen peas can be stored for a year or more before added to a TV dinner and the (DFP) of the whole package then is not indicative of this quality...." (The assumption has to be made that a frozen food manufacturer will store such peas at below 0°F. and that then quality will not deteriorate prior to their addition to other dinner components).

* * * * *

#355FIS stated,

"...We agree fully with the concept of case markings to facilitate proper stock rotation and follow this concept for our products. Many shipping containers are pre-printed at the vendors plant prior to receipt at the food processing establishment. To require, as you suggest, labeling of a specific date would involve increased supplier costs and cost increases due to excessive inventory controls. These costs would eventually have to be borne by the consumer.

"We believe that built in product quality is such that rotation on a specific day basis would not provide cost benefits to the consumer. Your stock rotation intent might well be satisfied if the shipping container code denoted month of manufacture (MOM). This approach recognizes that quality changes are almost impossible to detect over short periods of time and by its more practical nature, would stimulate greater interest and compliance by all segments of the industry.

"From our discussions, I understand the intent of this section (see II - Summary of Recommendations) is to allow industry the option of coding individual packages to meet their individual needs. This situation currently exists throughout the industry and legislative action is not required. Therefore, we would recommend deletion of this recommendation which is, in essence, covered under recommendation #F.

"(Reference to B in Summary of Recommendations). The issue of open date coding of individual packages has been dealt with quite adequately in the report. We concur with the position that open dating will not assure the consumer of always getting top quality. Time alone is but one factor affecting quality and of minor significance to the choice of raw materials, manufacturing methods, package design and packaging materials, care exercised in quality control, storage and transportation environment, and possible abuse due to excessive or fluctuating temperatures.

"Quality changes are often so slight and subtle that they are virtually undetected over short periods of time such as the duration of time from purchase to consumer use. Specific dates infer significant quality change taking place at a specific time. Such an assumption would lead to consumer rejection of slightly older packages with good quality merchandise left to be eventually destroyed. The selection process would also lead to increased handling damage of individual packages.

"Many food packages are small and irregular in shape with labels currently crowded with mandatory and instructional information. Meaningful code dating would require special coding areas frequently requiring larger labels.

"Your statement that-- 'as health hazard problems are low, there is no need to openly date individual packages with date of manufacturing or date of expiry,' is quite correct. We believe the same holds true for Date of Shelf Display (DSD). Consumer protection benefits would not justify the added accumulated expenses for implementation. These increased costs would undoubtedly result in higher costs for the consumer.

"(Reference to A in Summary of Recommendations). We fully agree that the consumer should be given adequate instructions on how to use and store products for maximum total quality and this philosophy is followed throughout our corporation. Our concern appears to center on the best approach for conveying such information to the consumer whether it be positive or perhaps negative, as you have recommended. (i.e., Do not store in hot humid areas vs. Store in a cool dry place.)

"Within our corporation an extensive staff of home economists and food scientists maintain continual rapport with consumers and instructions are in terms which experience shows have had the greatest impact on the consumer. The positive approach promotes good practices and avoids listing of all possible undesirable storage or handling situations.

"Differences in education and language comprehension make it almost impossible to establish uniform instructions for all situations. It would appear that some of the detailed information you desire conveyed to the consumer is of a general nature which might be better conveyed in newspaper articles and in public school home economics programs. Keeping food covered during storage or containers and utensils clean is information that can be best conveyed through such general informational programs.

"Would not a general recommendation be more appropriate? Perhaps requiring that where products require special storage or handling to maintain maximum quality such conditions be noted on the package label. We believe this would fulfill your intent."

In reply to an expert's query, a brief survey was conducted on the AFDOUS Code. The query was, "Has the AFDOUS Code been proven, in its some ten years of existence, to be beneficial to the consumer, the producer, and/or the law enforcement agencies?"

The replies were as follows:

An industry association (#80FIS) spokesman stated:

"...I have no information to even make an intelligent guess on whether or not the AFDOUS Code has proven beneficial to the consumer, the producer or to the law enforcement agency. The respective enforcement official in the states that have adopted codes may be able to give you an opinion. The states, to my knowledge, have not been very active in an enforcement program of the Code regulations.

"Educational programs by industry, the government-extension services, some of the colleges and universities have, in my opinion, contributed more to improved handling of frozen food than the AFDOUS Code. Other regulations such as FDA's GMP (Umbrella) Regulation have also contributed to improved handling along with the workshop and seminar programs, many of which have been industry-FDA projects.

"Actually, the AFDOUS Code is a very good 'Code of Practice' and as such certainly has helped to up-grade handling practices of frozen food. Many states use it as a guide to good commercial practices...."

An official of a retail association (#615FIS) stated:

"...The question which you raised in your letter of August 6, is bound to be one calling for an answer based on judgment and opinion, rather than other types of measurement. I'm glad to give you my opinion.

"Some three years before the adoption of the first AFDOUS Code, I served as chairman of an industry committee to consider proposals and make recommendations. At that time industry representatives felt very strongly that the imposition of legal requirements for maintenance of zero or lower temperatures for frozen foods would be completely unworkable. Reasons for this were essentially as follows:

- "1. Transportation equipment was, in many cases, inadequate to guarantee maintenance of zero or lower temperatures.
- "2. Display cases, equipment, and storage in retail stores were, in many cases, inadequate to maintain a constant zero or lower temperature.

"3. Although the industry generally recognized the need for maintenance of low temperatures, there still remained a substantial job of education of employees and consumers relating to handling methods and practices.

"The delay of three years gave the industry time to replace inadequate equipment and facilities with adequate equipment and facilities and to develop and put into effect better employee training and more extensive informational programs, for both employees and the general public. It also provided the time for scientific groups to make further studies and to give more authoritative information as to the effect of practices and/or equipment which permitted higher temperatures to prevail than those prescribed. Such measurements were directed toward not only the higher temperature in and of itself, but also the length of time which the product remained at higher temperatures, the number of times which it was subjected to higher temperatures, the results of re-freezing, etc. The delay gave equipment producers an opportunity to improve the equipment offered to frozen food handlers, all the way from producer through storage, transportation, retail outlet, and home holding facilities.

"It is my opinion that the improvements in equipment and handling methods and the recognition of the difference between 'refrigerated' and 'frozen' by both the industry and the consuming public would have occurred without the AFDOUS Codes. I do believe, however, that the program would have been slower. By speeding up the recognition of the importance of maintaining zero temperatures and the necessity for developing and installing better equipment and facilities along with better handling methods, the AFDOUS Codes have made a beneficial contribution to consumers and to the industry.

"It is quite clear that able merchandisers recognize that customers will not return for the purchase of frozen food items if they find the product of mediocre quality. By quality I mean, taste and appearance. Health standards for food were already taken care of by other laws on the books long before the AFDOUS Codes. It seems to me remarkable that the frozen food industry has been able to supply so many hundreds of millions of dollars of products with so few condemnations because of health hazards.

"Quality maintenance is in the industry's own interest and therefore they have been served by the impetus, generated by AFDOUS Codes to do a more effective job with resultant presentation to the public of a more attractive food product.

"I hope these observations may be of some value to you...."

Spokesmen for agencies charged with enforcing the AFDOUS Code in several States where it has been adopted offered comments as follows.

From Arkansas:

"...From our experience and knowledge we have noted a marked improvement in the processing, transportation, storage and display of frozen foods since the Regulations became effective in Arkansas in 1968. We

have had better understanding between Industry and the regulatory officials, especially among the smaller operators where most of our problems were. We have noted an improvement in processing equipment designed to be easily cleaned and especially improved transportation equipment which has been up-graded from many open nonrefrigerated vehicles to adequate refrigerated units ranging from dry ice to compressed nitrogen.

"These Regulations have encouraged retail merchants to give more attention to the proper back room and display storage of frozen merchandise

"We are well pleased with the program and cooperation we have received from Industry in keeping frozen foods adequately frozen and handled as foods should be handled from the processor to the consumer...."

From Oregon:

"...While Oregon has not adopted the model AFDOUS frozen food code, its contents have been used as the basis for sanitation and temperature control requirements for handling frozen foods in our regulations relating to food processing establishments, food storage warehouses and retail food markets.

"In my opinion the AFDOUS frozen food code has been very beneficial to the industry, regulatory agencies and the consumer. It has helped to standardize the frozen food requirements between states and the FDA. It has also helped to strengthen state and local standards and afforded more protection to the consumer...."

From Pennsylvania:

"...The enclosed Frozen Food Code, Chapter XXIII of our Regulations, was adopted on June 10, 1964. Our authority for requiring a zero degree temperature on our frozen foods during storage, transporting, and display is contained in the Frozen Food Code. Many hours have been expended by our Food Inspectors in 'checking' food transport vehicles. Numerous letters have been sent to violators calling their attention to our requirements noted in the Code.

"Over the years we have embargoed large quantities of frozen foods which were held or displayed at retail level over 0°F. Some of these foods were later voluntarily destroyed by the owner or released by this office, following grading by USDA in the case of vegetables; and following laboratory analysis on other foods. In many cases the costs for laboratory analysis were borne by the owner of the food.

"We feel that the Frozen Food Code has proven to be beneficial in Pennsylvania to both the consumer and the producer. It has been very helpful in our enforcement program. The AFDOUS Code would be more beneficial to Pennsylvania if it was adopted by other states, especially those bordering Pennsylvania...."

From Massachusetts:

"...In regard to your letter of August 7, 1970, please be advised that the Massachusetts version of the AFDOUS Code has been of tremendous benefit to all persons concerned with frozen food from manufacturing to consumers stage and of great assistance in carrying out the enforcement program pertinent thereto...."

FIS #165 stated:

"...It is our opinion that the AFDOUS Code has been beneficial. Our comment is from the standpoint of the producer, but we think it is beneficial to the consumer, in particular that frozen foods are maintained at 0°F. by the producer, transporter, warehouser and retailer. Any government regulation must be enforced to be effective, of course, and your question about effective enforcement should be directed to the State regulatory officials where the code has been adopted, such as the State of Maryland. However, it appears to be a practicable code and capable of enforcement.

"The development of the code and adoption by several states generated a considerable amount of activity on our part: insuring that plant freezers will maintain 0°F., providing facilities to protect product during hot weather loading, testing and specifying transportation equipment capable of maintaining 0°F., inspection of area warehouse freezers, and instructions to our salesmen and customers about proper handling of frozen foods in the retail store.

"I have talked with persons ... with experience in production, transportation, and retail sales. All agree that the AFDOUS Code has been beneficial. The comments were that frozen foods are handled much better in 1970 than they were handled in 1960. All of this improvement cannot be attributed to the AFDOUS Code, but it has certainly been a major contributor. Better transportation equipment and retail freezers are available; handlers are better trained throughout the entire marketing chain; better freezers are available in the home; there is a generally higher level of awareness about frozen food handling. There is, of course, room for improvement in all of these areas...."

A spokesman for another association (#90FIS) stated:

"...Your letter of August 6th was held for me pending my return. We here would have no information on whether the AFDOUS Code has been beneficial. While its goals are well intentioned, it basically expresses the goals of the frozen food industry itself -- to provide the consumer with frozen foods of the best quality, under the best conditions. We do know that the industry has been developing its own handling practices guidelines. Such voluntary efforts can be most effective...."

An official of the Florida Department of Agriculture and Consumer Services stated:

"...To our experience, this code has been of benefit to some producers and law enforcement agencies.

"We are of the opinion that it has not been of benefit to the consumer...."

From a Maryland official, this comment was received:

"...The AFDOUS Code has been used by states and cities as a law, regulation and guide line. In those areas where it has been used as a regulatory tool, it has been more effective than where it was used only as a guide line. There are a few states who have failed to take advantage of its use in any form.

"The frozen food industry has probably gained more advantages from its use than any other group. It helps to keep 'fly-by-night' operators from competing with legitimate operators and has provided the consuming public with a better frozen product than was being sold prior to AFDOUS work on the code. It has helped educate both the consuming public and the industry as to its advantages in product quality.

"Probably the greatest deterrent to any effective use of the code is lack of trained personnel...."

A spokesman for the State of Connecticut stated:

"...For many years, prior to the adoption of the Code in Connecticut which occurred in March of 1962, we realized that there were many abuses in the handling and distribution of frozen foods within the state. The 1955 General Assembly passed legislation authorizing the then Food and Drug Commission to promulgate regulations for the storing and transportation of frozen foods, including temperature control, sanitation and other matters in accordance with recognized standards necessary for the protection of public health and the preservation of such foods in wholesome condition. As a result of this legislation, we adopted the AFDOUS Code in 1962.

"Connecticut was one of the first states to adopt the Code and ever since its adoption we have observed in Connecticut a great improvement in all conditions pertaining to frozen foods--right from the processing level to the time the frozen food reaches the consumer at the retail level.

"I believe that the regulations thus adopted have been highly beneficial to the consumer as they have greatly improved the frozen foods as the consumer purchases them in the retail store. They are beneficial also to the producer who produces a high-quality article due to the fact the regulations provide that frozen foods be maintained at low temperatures and, therefore, maintain their quality.

"Finally, the regulations have been of great benefit to the law-enforcement agency because they give the agency a powerful tool that can be used when occasion demands to require frozen foods to be manufactured, held, and distributed under proper conditions.

"To say that these regulations have eliminated all bad practices in the frozen food industry would be a misnomer but the number of unsatisfactory practices observed are now in the minority and, for the most part, are due to carelessness at the retail level and improper delivery of frozen foods from wholesalers to retailers...."

FIS #45 stated:

"...The AFDOUS Code has been of considerable help to food processors. Basically, it has made these companies, and many retailers, more aware of the need to maintain zero temperature in storage, shipping and display. Surveys of pot pies (all brands) made fairly recently show great improvement over the findings of surveys made before the code was drafted. The consumer, naturally, must benefit from this. Of course, it is impossible to say how much this can be attributed to the code itself, or to the atmosphere of responsibility and concern which the code helped generate, and how much to technological advances which the industry has made as a matter of enlightened self-interest. Improved quality plus food safety equals sales.

"On the other hand, enforcement of the code at the retail level has not been as effective as might be hoped for. This is a spotty situation and varies from state to state, city to city and store to store. When Massachusetts first passed a law which included AFDOUS provisions, there was a flurry of enforcement activity which seems to have died down. In many states, enforcement has been almost entirely absent.

"There is an agreement that major food chains are making a major effort to control their outlets. However, in the case of many smaller independents, there seems to be little realization of the need for self-policing...."

A spokesman for a transportation association (#635FIS) stated the following in a letter to M. J. Brennan, director of the food stability survey:

"To my knowledge no motor carrier has made any such survey to determine the effects of the AFDOUS code on the consumer, the producer, or the law enforcement agencies. We know that the code has been in effect in some states as law, and in other states it has been a voluntary proposition. We also know that there are laws that are enforced and laws that are not enforced, and we know from experience that the AFDOUS code is not being rigidly enforced in those states where it has been enacted into law. So if it is not being enforced, then it could not be said to be a benefit to the consumer, the producer, or the law enforcement agencies.

"In checking Section F of the AFDOUS Code under Transportation, we know that certain portions of this code are simply a matter of common sense and the motor carriers could not even exist today unless they adhere to this code. There are other sections that are not being adhered to, and I refer specifically to Section 2, paragraph B which states 'Frozen food shipments shall not be accepted for transportation when the internal product temperature exceeds 0° Fahrenheit.' As we have said before, dough

products and other bakery products are transported at temperatures above 0° because it is extremely difficult to maintain 0° on this type of product.

"Under paragraph 2, Section D, there is a notation or requirement, 'The mechanical refrigerating unit of vehicles shall be turned on and doors of vehicles shall be kept closed during any time interval when loading, or unloading operations cease.' We know that this is not being done in a great many instances because we have found through tests that the only benefit of having the unit running while loading is to keep the laborers cool who do the unloading...."

The American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc., discussed temperature and frozen foods in a summer 1970 meeting. Portions of that meeting and comments received from an ASHRAE official are provided here.

"Subject: News Letter and Report of ASHRAE Committee
T.C.-7.6 Meeting of Kansas City, June-July 1970

"...Forum or Symposium Sponsored by 7.6. The Semiannual ASHRAE meeting is to be in Philadelphia on January 25-28, and the Annual Meeting is to be in Washington, D.C., on August 24-25, 1971. A brief review was presented by this chairman of the Rutgers Food Stability Survey with specific relation to frozen foods. The subject 'Stability of Frozen Foods' was voted unanimously as being fit for a forum to be offered by 7.6 at Washington (subject to acceptance by Dick Perry)....

"...Task Group Research Project. George Lorant had recommended in our Denver meeting a project for a study on temperatures of foods in home freezers. He had sent a considerable set of confidential reports and published documents on the subject, and Dr. Kermit Bird had contributed correspondence and reports from USDA....ASHRAE's support might later be sought on studying effects of the defrost cycles and on promoting redesign of cabinets...Further Task Group Project. Dr. Hayakawa proposed an extension of the above Lorant study to concern the relation of package content temperature to ambient refrigerator temperature in retail cabinets and at home with special reference to self-defrosting systems. Quality-deteriorating concerns are mechanical and operational matters such as effect of lights, blocked convection, poor gasketing, improper stacking, overfilling, and not covering open cabinets at night. Spot checks in markets and homes and improvised models were suggested. Design improvements could follow, possibly by refrigeration engineers. In order to round out expertise of 7.6, it was proposed to invite as an additional member of 7.6 William Webb of General Electric Company, an authority in home refrigeration equipment. This is being done by copy to him of this News Letter...."

"...Subject: CONSIDERATION OF A RESEARCH PROJECT BY TC 7.6...Several comments are suggested by your expressed interest in 'research' to determine 'the relation of package content temperature to ambient refrigerator temperature in retail cabinets and at home with special reference to self-defrosting systems, etc.'"

1. I believe you will find that the various relationships to which you refer are quite well known by the manufacturers of retail cabinets, home freezers, combination refrigerators-freezers, etc. (I know these relationships have been thoroughly examined by manufacturers, consumer-oriented test laboratories, USDA and others, because I had many years of personal experience in this field with company names.)
2. Temperature variations which occur during the handling of perishable foods including frozen foods, at all stages, are so much greater than during display and storage that the latter seems almost inconsequential by comparison.
3. Considering item 2, there is very little incentive for refrigeration engineers to make "design improvements" on the storage cabinets, display cabinets and home refrigerator-freezers. I'm sure they are perfectly capable of making design improvements if convincing justification for such improvements can be presented.
4. Your committee could probably make its best contribution to this area by documenting the degree of deterioration which occurs in perishable foods because of temperature variations over various periods of time.
5. Finally, it would seem to me that you should invite TC 7.4, Frozen Foods, TC 8.1, Domestic Refrigerators and Food Freezers and TC 8.5, Commercial Food Display and Storage Equipment to comment on your proposed study. There is a possibility that your Committee is overlapping areas of responsibility already assumed by one or more of these other TCs and on which they have much information of which your Committee is not aware...."

CODE
OF
RECOMMENDED PRACTICES
FOR THE
HANDLING OF FROZEN FOOD

FROZEN FOOD COORDINATING COMMITTEE

919 - 18th Street, N.W.

Washington, D. C. 20006

Used with permission of Frozen Food Coordinating Committee.

STATEMENT OF PURPOSE

CODE OF RECOMMENDED PRACTICES FOR THE HANDLING OF FROZEN FOODS

REVISED SEPTEMBER 1, 1970

In order to safeguard frozen food quality for the benefit of the consumer, the undersigned related trade groups do hereby establish a code of recommended handling practices for frozen foods, which procedures are based upon expert advice and scientific evidence.

The subjects covered by these recommended practices relate to merchandising aspects of frozen foods. The frozen food industry trade groups which have joined in subscribing to these recommended voluntary operating practices have done so in an organized effort on their part to insure that new technological developments will continually be made available to the industry and help to concurrently up-date good practices for the care and handling of frozen foods. They have taken this action in recognition of their mutual responsibilities to the consuming public, and pledge in good faith their best efforts to obtain voluntary compliance with these recommendations.

These recommended practices are the result of careful study by the industry with scientific advice and assistance. They are based upon findings of extensive research in frozen food time-temperature-tolerance by the Western Utilization Research and Development Laboratory of the United States Department of Agriculture which were concurred in by The Refrigeration Research Foundation. They are sound and practical for application to those food products intended to be sold in frozen state.

In the context of the industry's program of progressive self improvement, these practices are endorsed by the undersigned organizations, but they do not replace in any instance more demanding company or industry practices which may be in effect. The industry's goal is to maintain reasonably uniform frozen food product temperatures of zero degrees F or lower and to insure their proper care, from packer to consumer. These recommendations are designed to insure this and will be re-evaluated periodically to keep them in accord with new developments within the industry.

The development of these recommendations was based upon the principle that voluntary action taken by industry members would result in more rapid advancement and attention to good care and handling practices than would be produced by compulsion of laws and regulations. With its practical knowledge and experience, the industry itself, backed by guidance and assistance from scientific authorities and recognized experts, is in a unique position to develop optimum practices to insure its consumers the highest quality frozen food products.

I. FOODS FOR FREEZING

1. Raw products should be harvested at optimum maturity, then delivered promptly to the plant where they should be prepared for freezing, frozen and packaged (or placed in proper bulk storage) with all reasonable speed. Similarly, frozen products to be used as ingredients in prepared frozen foods should be of best quality for the intended purpose, handled at temperatures of zero degrees F or lower at all points and only permitted to thaw for the time and to the extent necessary for their incorporation into the end product.
2. Similar care should be used by processors without freezing facilities in moving prepared or packaged product to refrigerated warehouses for freezing.
3. Where processor has his own freezer and warehouse, product should leave the warehouse at zero degrees F or lower.
4. In movement from processor, who freezes but does not have sufficient warehouse space to complete freezing, the product should leave the plant without delay, at ten degrees F or lower, in an insulated and refrigerated vehicle. Such movement to the primary warehouse for reduction of temperature to zero degrees F or lower should not exceed eight hours.
5. Product temperatures should be reduced to zero degrees F or lower promptly upon reaching the primary warehouse.

II. WAREHOUSE EQUIPMENT

1. Each warehouse should be of adequate capacity and should be equipped with suitable mechanical refrigeration to provide, under extreme conditions of outside temperature and peak load conditions, for maintaining an air temperature of zero degrees F or lower, in all rooms in which frozen foods are stored.
2. Each storage room should be equipped with an accurate temperature measuring device so installed as to reflect correctly the average air temperature of the room. Each day the warehouse is open, temperatures of each room should be recorded, dated and a file of such temperatures maintained for a period of at least two years.

III. WAREHOUSE HANDLING PRACTICES

1. The warehouse operator should record product temperature of each lot of frozen foods received, and should accept custody in accordance with good commercial practice. He should retain lot arrival temperature records for a period of at least one year.
2. Whenever frozen foods are received with product temperatures of fifteen degrees F or higher, the warehouseman should immediately notify the owner or consignee and request instructions for special handling.

These procedures may consist of any available method for effectively lowering temperatures such as blast freezing, low temperature rooms with air circulation and proper use of dunnage or separators in stacking.

3. Before a lot of frozen food is placed in storage, it should be code marked for effective identification.

4. Frozen foods should be moved over dock areas promptly to minimize exposure to elevated temperatures, rainfall or other adverse weather conditions.

5. If frozen foods are purchased for resale directly to consumers, such products should be stored in the purchaser's own premises, (regardless of whether such premises are owned or leased from a public warehouse or others) to the effect that purchaser would have complete control of all of the conditions for which he is responsible in adhering to the code. The "first-in, first-out" method of inventory control is desirable.

6. During defrosting of overhead coils in storage rooms, stacks of frozen foods should be effectively protected by tarpaulins or other protective covering, or by removal from beneath the coils.

7. Frozen foods going into a separate break-up room for order assembly must be moved out promptly unless break-up room is maintained uniformly at zero degrees F or lower.

IV. TRANSPORTATION EQUIPMENT

1. All Vehicles Railway Cars, Motor Trucks, Trailers and Ships should be . . .

(a) . . . so constructed and properly insulated that, when equipped with appropriate refrigeration units, they will be capable of maintaining product temperature of zero degrees F or lower throughout the load in all movements.

(b) . . . equipped with an appropriate temperature measurement device to indicate accurately air temperature inside the vehicle. The dial or reading element of the device should be mounted in a readily accessible position outside the vehicle.

(c) . . . equipped with air leak-proof cargo spaces, including tight fitting doors and suitable closures for drain holes to prevent air leakage.

(d) . . . racked, stripped, baffled or otherwise so constructed as to provide clearance for air circulation around the load, unless of cold-wall or envelope type construction.

NOTE: Floor racks will not be necessary when product is palletized or is loaded on extruded floors; however, such floors must be free from any dirt and debris. It is recommended that ceiling air circulation ducts extend from the air circulating fans to at least three-fourths the length of the load.

(e) entirely free from any dirt, debris or offensive odors when placed for loading.

2. Route Delivery Trucks should comply with all the provisions of Section One above, and in addition, should be equipped with curtains or flaps in the doorway area, or with port doors, to minimize loss of refrigeration during delivery stops.

3. Self-refrigerated containers and other self-contained units utilized in making small shipments of frozen food, such as those which might move in LCL or LTL lots via aircraft, Railway Express, pickup trucks and other non-refrigerated vehicles should be so constructed as to give the product adequate protection against physical damage in transit and be equipped with a refrigerant or refrigerating system capable of maintaining a product temperature of zero degrees F or lower during the anticipated movement. All such containers should be free from dirt, debris and offensive odors when offered for loading.

V. HANDLING PRACTICES FOR LINE-HAUL OR OVER-THE-ROAD TRANSPORTATION

1. All vehicles should be pre-cooled to an inside air temperature of twenty degrees F or lower prior to loading, and after completing pre-tripping procedures.

2. Frozen foods should be securely packaged before they are offered for transportation.

3. Product temperature should be zero degrees F or lower when tendered to carrier for loading. Carrier should not accept product tendered at temperature higher than zero degrees F. Shipper, consignor or warehouseman should not tender to a carrier any container which has been damaged or defaced to the extent that it is in an unsalable condition.

4. Carriers should provide their personnel with appropriate testing thermometers and instruction in proper procedure to determine that the product they receive is at zero degrees F or lower. Arrival product temperatures should be taken inside the vehicle within a reasonable time after arrival and prior to any unloading. However, the carrier must continue to protect the product until such time as the consignee is ready to accept that which the carrier is ready to tender.

5. No product should be loaded in such manner in any vehicle that it will interfere with the free flow of air into or out of the refrigeration unit, nor with the free flow of air around the load in vehicles of other than envelope or coldwall type construction, or those using Freon or liquid nitrogen as a refrigerant.

6. Vehicles should be loaded and unloaded within allowable free time as provided for in governing tariffs to prevent accrual of detention charges.

7. The vehicle's refrigeration unit should be turned on and the doors kept closed during any period when loading and unloading operations cease.

8. The thermostat on the vehicle's refrigeration unit should be set at zero degrees F or lower.

9. Bills of lading and waybills should bear the following or similar notation:

“**FROZEN FOODS** - - - to be tendered and transported at a temperature no higher than zero degrees F, and the lading space temperature shall be controlled accordingly.”

10. After loading has been completed and the vehicle doors closed, the carrier's equipment should be checked prior to departure to insure that the refrigeration system is in proper working order.

VI. HANDLING PRACTICES FOR ROUTE DELIVERY

1. All applicable sections under the part on over-the-road haul transportation above should be followed in the case of route delivery.

2. In addition, each lot for individual consignment should be refrigerated by means of mechanical refrigeration, or by any other method of maintaining product temperature.

3. Vehicles or containers should be pre-cooled to a temperature of twenty degrees F or lower before being loaded with frozen foods.

4. Doors of route delivery trucks should be kept closed during any period when loading or unloading operations cease. In addition, door curtains or flaps should be used during actual unloading, if the vehicle is not equipped with port doors, to minimize loss of refrigeration.

VII. STORAGE FACILITIES FOR RETAIL STORES

1. Frozen food storage facilities should be capable of maintaining a product temperature of zero degrees F or lower.

2. Cabinet type frozen food storage facilities should be defrosted as frequently as necessary to maintain refrigeration efficiency, and should be equipped with an accurate thermometer indicating a representative air temperature.

3. Frozen food storage facilities should have provision for circulation of refrigerated air and should be defrosted as frequently as necessary to maintain refrigeration efficiency. Such facilities should be equipped with an accurate thermometer, the sensing element of which should be located within the upper third of the distance between the floor and ceiling, but not placed in a direct blast of air from the cooling unit, cooling coils, heat exchange units or near the entrance door.

VIII. RETAIL DISPLAY CASES

1. Display cases should be capable of maintaining an air temperature of zero degrees F or lower.

2. Frost on the refrigerated coils and in air passages of the display cases should be removed as frequently as necessary to maintain refrigeration efficiency.
3. Each display case should be equipped with an accurate thermometer, the sensing element of which is located within the path of refrigerated air being returned to the evaporator coils.
4. Product load line should be the highest point of discharge and return of refrigerated air, and said load limit line should be designated by a distinctive line at the inside of each display case.
5. Each display case should be equipped with separators to provide false walls to insure free circulation of refrigerated air around the displayed product.

IX. RETAILER HANDLING PRACTICES

1. Frozen foods should not be accepted by a retail outlet when product temperature exceeds zero degrees F. Department or store manager should approve any product rejection.
2. All frozen foods at a retail outlet should not come to rest except in frozen food storage or display cases having the characteristics described above.
3. Each retail outlet should be equipped with frozen food storage facilities of sufficient cubic capacity to accommodate those frozen foods (except those to be sold in thawed or semi-thawed condition) that are not placed directly in display case at time of delivery.
4. Retailers should not place frozen food above the designated load limit line.
5. Retail outlets should employ the "first-in, first-out" method of inventory control.

X. STORAGE FACILITIES FOR FOODSERVICE INSTALLATIONS

1. Frozen food storage facilities should be maintained at an air temperature of zero degrees F or lower.
2. Total storage facilities should be of sufficient cubic capacity to easily accommodate frozen foods in quantities anticipated for operation of the installation, taking into account frequency of deliveries, probable peak requirements, ordering practices and related factors.
3. Cabinet type frozen food storage facilities should be equipped with an accurate thermometer indicating a representative air temperature, and should be defrosted as frequently as necessary to maintain refrigeration efficiency.

4. Walk-in type storage facilities should have provision for circulation of refrigerated air and should be defrosted as frequently as necessary to maintain refrigeration efficiency. Such facilities should be equipped with an accurate thermometer, the sensing element of which should be located in the upper third of the distance between the floor and ceiling, and away from any entrance door or direct air blast from cooling unit or evaporator coil.

XI. FOODSERVICE INSTALLATION HANDLING PRACTICES

1. Frozen foods should not be accepted by a foodservice installation when product delivery temperature exceeds zero degrees F. Installation manager or his designee should approve rejection.

2. All frozen foods received at a foodservice installation should be placed promptly in storage facilities having the characteristics described above. Product should be removed from storage in quantities only sufficient for immediate use.

3. Foodservice installations should rotate frozen food inventories on a "first-in, first-out" basis.

XII. PRODUCT TEMPERATURE

1. Product temperature is that steady temperature determined by . . .

(a) . . . opening the top of the case, removing two corner packages, punching a hole through the case wall proceeding from the inside at a point coincident with the center of the first stack of packages and the first and second layer of packages, inserting the sensing element of an accurate dial thermometer or other appropriate means of temperature measurement about three inches from the outside so that it will fit snugly between the packages, replacing the two corner packages, closing the case and placing a couple of cases on top to insure good contact with the sensing element of the thermometer. or . . .

(b) . . . using a sharp blade partially cutting out a small section of the case wall in the approximate area of the first stack of packages and the first and second layer of packages, slitting the cut section to allow for insertion of the sensing element and proceeding as in paragraph (a) above.

2. Only when an accurate determination of temperature fails without sacrifice of packages of frozen foods should representative packages or units be opened to allow for insertion of the sensing element for temperature measurement to the approximate center of the packages in question.

3. All temperature measuring equipment should be of high quality and subject to periodic checking for accuracy, employing methods recommended by the manufacturer.

NOTE: It is recommended that frozen food handlers, concerned with the taking of temperatures of frozen foods, refer to Technical Service Bulletin No. 7, entitled "Frozen Food Temperatures -- Their Meaning and Measurement" issued by the American Frozen Food Institute. This outlines in detail correct methods for taking product temperatures, describes appropriate equipment for the purpose, discusses certain considerations for proper care and handling of frozen food and cites certain pertinent provisions of the AFDOUS Model Frozen Food Code.

BEVERAGES

I. INTRODUCTORY REMARKS

Beverages in general are consumed for enjoyment and stimulation. They are mixed with other ingredients either to mask unpleasant flavors or to create combinations. The drinking of beverages serves as a convenient and enjoyable means of imbibing water. Aside from the important function of supplying water to the human body, beverages in this section are not discussed for nourishment they may contain.

A. Soft Drinks and Mixes

Soft drinks and mixes are represented by such popular types as the cola drinks, ginger ale, and many others. Fruit-flavored drinks, whether of natural or imitation flavors, are well represented by the carbonated, noncarbonated, and dry-mix beverages.

B. Coffee: Roasted and Instant

The U.S. consumer has become so sophisticated in his judgment of coffee beverage quality that it is questionable how much quality protection the public may need through date coding. Just as British populations (in the United Kingdom, Australia, Canada, New Zealand, etc.) have become acculturated to standards of tea brew quality that demand certain blends and exacting techniques of preparation and extraction (kind of water, degree of boiling, time of infusion, addition of milk, etc.), the American public is equally educated and discriminating in judging coffee quality. There are regional preferences for types of blend, bean varieties, and degrees of roast. In some southern States, there is a preference for coffee containing some roasted chicory. Institutional users may add chicory for urn coffee which, when added at a level of about 15 percent (85 percent coffee), simulates coffee bitterness and gives added body and color, thereby extending the yield of cups per pound of roasted coffee.

Manufacturers of instant coffee have derived high yields from roasted, ground coffee by the use of high-pressure, high-temperature percolation methods. Typical factory extraction of soluble solids could be about 40 percent of the roasted bean weight, whereas the home preparation might yield only 28-33 percent. The recently available freeze dried instant coffees have retreated toward the home level of yields (28-33 percent) which is one major reason for the much higher cost of this new product compared with conventional spray-dried instant coffee. Whereas about 18-20 percent of roasted coffee goes into the manufacture of instant coffee, at least 30 percent of the cups of coffee consumed in the United States are made with instant coffee because of the higher manufacturing yield of water-soluble coffee solids.

C. Tea

Tea consists of dried end leaves of tea bushes grown in semitropical and tropical climates. New shoots are plucked, withered, "rolled," fermented, and

dried to produce the black tea commonly sold in the United States. Green, unfermented tea is now almost a curiosity here.

The position of tea in U.S. sales is much lower than that of coffee (0.37 percent of total sales in retail markets versus 2 percent for coffee). However, unlike coffee's per capita retail plateau, sales of tea in its old and new forms have begun to rise. Tea bags now dominate very markedly over loose tea--about 5 to 1--but the recent great growth has been in instant tea which now constitutes over 30 percent use of the imported leaf. A newer phenomenon is the success in marketing of various sweetened and flavored tea beverage powders based on instant tea powder.

Tea leaf in its clean dry form is imported in moisture-tight aluminum lined plywood chests, mainly from India, Indonesia, Africa, and Ceylon, but sometimes from intermediate brokerage centers in London, Hamburg, and Rotterdam. Prior to entry into the United States, each lot is examined for foreign matter, adulteration, and infestation. Also, beverage standards must be acceptable to experts of the Tea Import Board. Leaf size, color, and appearance factors have declined in importance as tea bags and instant tea have become preferred by U.S. consumers.

II. SUMMARY OF RECOMMENDATIONS (see section IX)

A. Adoption by the New Jersey Department of Health of the coding recommendations of the FDA Good Manufacturing Practices, Federal Register, April 26, 1969, for processed foods. Disclosure of code meanings by food manufacturers to the New Jersey Department of Health on request by the latter.

B. Adoption of the open date of manufacture labeling for all outer cases/overwraps, etc., to assist in stock rotation.

C. Voluntary coding of all individual containers in such cases/overwraps by the food industry with codes of its own choosing (similar in intent to A. above). Such codes should indicate plant location, date of manufacture of final product in container, shift, production line, and any other product aspects, at the manufacturer's discretion.

D. Stamping of date of shelf display by retail stores for stock rotation and as a consumer aid in home storage stock rotation. Regular carbonated beverages, owing to their high turnover rate, should be excluded.

E. Expansion of instructions for consumers' use and storage. Regular ground coffee instructions should read, "Tightly reclose and refrigerate after opening." Instant coffee and tea label instructions should read, "Tightly reclose after use."

III. TYPE OF FOOD AND PRODUCT GROUPS

Beverages, by product group, category, and variety

Product group	Percent- age of total sales	Product category	Percent- age of category sales	Percent- age of total sales	Product variety	Percent- age of depart- ment sales	Percent- age of total sales
Soft drinks & mixes	1.69	Carbonated soft drinks	92.4	1.562			
					Regular bottled	68.0	1.149
					Regular cans	14.7	.249
					Low calorie	9.7	.164
						<u>92.4</u>	<u>1.562</u>
		Soft drink	7.0	.118			
					Powders, presweet- ened	4.6	.078
					Powders, regular	1.7	.029
					Ice bar mixes	.3	.005
					Syrups	.2	.003
					Tablets	.2	.003
						<u>7.0</u>	<u>.118</u>
		Nonal- coholic cocktail mixes	.6	.010			
					Liquid	.5	.008
					Powdered	.1	.002
						<u>.6</u>	<u>.010</u>
Coffee	2.07	Ground	100.0	1.690			
			71.5	1.490			
		Regular (perc.)					
					Drip	40.8	.841
					All purpose	14.6	.296
					Elec. per- colator	7.9	.157
						7.7	.155
					Fine	.5	.041
						<u>71.5</u>	<u>1.490</u>
		Nation- ality & other speciality coffee	1.5	.009			

Source: Adapted from Chain Store Age, 1969 Supermarket Sales Manual (1), Lebhar-Friedman, Inc. (used with permission of publisher).

Beverages, by product group, category, and variety (cont'd)

Product group	Percent- age of total sales	Product category	Percent- age of category sales	Percent- age of total sales	Product variety	Percent- age of depart- ment sales	Percent- age of total sales
		Instant coffee	21.4	.450			
					2 oz.	2.6	.057
					4 oz.	.4	.009
					5 oz.	3.3	.070
					6 oz.	6.5	.133
					8 oz.	2.1	.048
					10-16 oz.	6.5	.133
						<u>21.4</u>	<u>.450</u>
		Freeze dried, all sizes	5.6	.122			
			<u>100.0</u>	<u>2.071</u>			
Tea	.37	Tea bags	65.8	.243			
					Std. 16 count	8.3	.031
					Std. 48 count	22.5	.083
					Std. 100 count	23.2	.085
					All other sizes and counts	<u>11.8</u>	<u>.044</u>
						65.8	.243
		Instant Liquid Loose/bulk tea	27.8	.103			
			<u>6.4</u>	<u>.024</u>			
	<u>4.13</u>		<u>100.0</u>	<u>.370</u>			

IV. TYPE OF PROCESSING AND PRESERVATION

A. Soft Drinks and Mixes

Flavoring materials for these products have various origins. Some are in the form of oils derived from fruits, some are extractives from plants or herbs, and some are from synthetic imitative flavoring materials. Sweetening agents such as sugar, corn sugar, corn syrup, and the synthetic substitutes are used quite extensively. Water is the largest component of all the liquid products.

Legally permitted coloring is frequently added, as well as "fruit" acids such as citrus and malic. Carbon dioxide is added to all so-called carbonated beverages. Preservatives such as sodium benzoate are often used. Pasteurization of the concentrated syrup or of the finished beverage is often carried out.

Potable water must be used and treated to remove all foreign matter, whether by simple filtration or by chemical treatment to remove such minerals as calcium, magnesium, and iron.

Some soft drinks are prepared by manufacturing the concentrated flavoring syrups at a central plant, and shipping these, usually by tank truck, to local bottling plants where the syrup is diluted, carbonated, and bottled. Soft drinks are currently being packaged in glass bottles and cans.

Quality of soft drinks produced by large manufacturers is analytically controlled for carbon dioxide content, color, sweetness, acidity, and Brix, which measures the sugar percentage of syrup. Both the water used in processing and the syrup are bacteriologically analyzed for bacteria, yeasts, and mold content.

The dry mixes are essentially flavor extractives made into dry materials such as dextrose, to which dry sweeteners, color, and possibly "fruit acids" are added.

B. Coffee

Roasted beans are still the dominant form of coffee sold, either preground and packed hermetically in cans or ground from whole beans within the store and poured back into fold-top bags. The latter is identified with chain supermarkets that roast their private label blends, arrange for delivery at frequent intervals with company trucks, and rely on a controlled turnover to assure freshness with economy of cost.

The green (unroasted) beans imported here have already undergone considerable processing in the country of origin (principally South America, Central America, and Africa). The beans are actually hemispherical or oval seeds or cotyledons which usually grow as pairs within the cherry-like fruit of coffee trees. The cherries are plucked when ripe, the pulpy exterior removed or pulped by roller milling, and the mucilaginous seeds then spread out and allowed to "ferment" by natural or supplemented enzyme or chemical action. The mucilage of the fermented beans falls away easily. The seeds are then usually washed (unwashed are "natural") and always dried. Drying can be by solar or by machine methods. The dry beans are graded and sorted by size and quality and are stored and shipped in clean burlap bags. After drying, green coffee beans are stable for periods of about 2 years, provided they are stored in cool, ventilated, low-humidity warehouses. Since quality deterioration becomes critical not at this stage but after roasting, roasting is not done in the country or regions of coffee bean production.

Roasting consists of heating the beans while tumbling or rotating them in moving streams of combustion gases and hot air, followed by a cooling period. Roasting times can vary from 5 to 20 minutes depending on bean size and type of equipment. Heating temperatures exceed 400°F. so that after an initial period

of warm-up and drying the beans actually start to undergo combustion themselves. An exothermic reaction (pyrolysis) is initiated, during which the "burning" beans generate carbon dioxide mainly from carbohydrates and acids.

The amount of combustion necessary during roasting is determined by color and degree of roast desired. The beans are cooled with air and water sprays.

The roasted beans retain considerable carbon dioxide (CO_2) absorbed from their own combustion and the heating gases. This CO_2 is a key factor in the can packing of coffee for sale at retail. When the cooled roasted beans are ground, they diffuse large volumes of CO_2 and accordingly are stored after grinding for 2-8 hours to allow CO_2 to escape. Vacuum packing consists of filling ground coffee into cans and evacuating the chamber space (29-inch mercury vacuum) to remove oxygen from the bean interstices and the can space. Once the cans are covered, the beans start to evolve CO_2 into the voids, and the interior of the can rises in pressure until it actually exceeds outside atmospheric pressure. The ideal situation to preserve product stability and aroma is to have the ground coffee in an atmosphere of inert CO_2 having no residual oxygen. A very small quantity of oxygen--2 percent or less of the trapped gases in the can--is sufficient to initiate reactions that oxidize aroma and flavor in the ground coffee, producing a stale off-taste. This occurs if evacuation during canning is 27 instead of 29 inches Hg.

Instant coffee is processed by extracting roasted ground coffee by high-pressure, high-temperature methods. The grounds are removed and the liquid is concentrated with special effort made to trap volatile aroma and flavor compounds. Then they are dried by spray-drying or freeze-drying techniques.

Recently, imports of bulk-packed, freeze-dried and spray-dried instant coffee from Latin America have increased. In the United States, the material is sometimes blended with domestic products, thereby reducing costs. However, unknown age factors are also introduced into the products. But, as with mixes and other foods of a commodity nature, the manufacturer needs to have a quality assurance schedule of shelf-life tolerance related to his testing experience. After remanufacturing the product, he does his own shelf-life testing on his finished product.

C. Tea

Traditional leaf tea, or tea bag tea, requires skillful blending of raw leaf ingredients from various tea-growing areas of the world to meet established preferences for flavor, color, and sometimes clarity in iced beverages made from tea bags. The blending process consists of tumbling and mixing, sometimes followed by size cutting for tea bag use. Instant tea manufacture is a new art that employs the engineering operations of water extraction, concentration of the extract and drying, mainly by spray drying and sometimes by vacuum drying. To promote ease of solubility and crystal clarity in cold water for iced tea purposes, the solids in the extract are specially fractionated and are precipitated at low temperature. These separated solids are then removed by centrifugation. They may be discarded or treated by special chemical processes that make them soluble at even cold water temperatures. In the latter case, they are then restored to the extract or concentrate and the total solution is dried.

Tea leaves, tea bags, and tea powders are normally packaged to exclude moisture and sometimes light. Unless they inadvertently are stored in humid atmospheres and are permitted to absorb moisture, they maintain their quality over very long periods of time, often up to several years.

V. QUALITY CHARACTERISTICS

A. Soft Drinks and Mixes

All soft drinks and mixes are used for their characteristic flavors. In liquid beverages, clarity is also a high U.S. requirement except in those intentionally made cloudy, such as beverages derived from citrus products or those intended to simulate citrus products.

The dry mixes are required to retain adequate flavor to make acceptable beverages when dissolved in the designated amount of water. They must remain free flowing, dissolve without lumping, and possess high-clarity qualities when in solution.

These soft drinks and mixes as well as coffee and tea are not normally consumed as sources of nutrition. Their caloric (sugar) content is important since the amount of calories contained in a large intake can add to a person's total diet.

Normally, there are no pathogenic bacteria connected with soft drinks; consequently, they do not constitute a health hazard. However, the possible residual or accidental introduction of salmonella bacteria into dry mixes may occur but is not related to storage.

B. Coffee

Coffee--brewed from ground roasted coffee--is judged by flavor and aroma. Taste preferences for coffee vary widely between the extremes of very mild tasting brew to the concentrated demitasse type which is relatively bitter and pungent. Instant coffee solutions do not provide some of the pleasant aroma available from freshly brewed coffee. The freeze dried instant coffees have been made to retain as much of this aroma as possible. Flavor and aroma are extremely subjective matters. Professionally trained tasters are considered objective, however, and must remain so to blend tea and coffee mixes to a company image time after time. The U.S. Army has conducted experiments in the field, switching coffees of different types, i.e., ground and instant, etc., and were consistently informed by their soldier tasters that there was a distinct difference and notable preference for brewed coffee over instant. However, such judgments were in total disagreement with the facts, since the instant was often confused with brewed coffee and vice versa. (2)

There are no known microbial health hazards associated with coffee--roasted and ground or instant.

C. Tea

Infusions of tea differ considerably according to variety, but acceptable flavor is the predominant characteristic required. In regular tea, clarity of

the infusion is also of importance, but can be readily brewed to suit individual desire. Clarity is of much greater importance in instant iced tea preparations.

There are no microbial health hazards associated with tea, either in leaf or instant form.

If shelf life presents problems to processors, some areas needing particular attention are:

- (1) Maintenance of best sanitary practices throughout the operation
- (2) Pasteurization at critical stage of operation
- (3) Establishing as low a pH of the product as practicable and maintaining uniform pH
- (4) Routine microbiological surveillance of process and finished products
- (5) Use of preservatives according to Federal and State requirements.

VI. PROCESSING AND STORAGE QUALITY LOSS FACTORS

A. Soft Drinks and Mixes

The statements made by a large producer of soft drinks (#325FIS) indicate that spoilage of bottled beverages can take the form of loss of flavor as well as visible changes from emulsion breakdown. These possibilities are substantiated in a report of a study on beverage shelf life by the firm of Naarden (3). If spoilage takes place, yeasts are most likely to be the cause of deterioration, followed by lactic acid bacteria and sometimes molds.

The acidity (pH) of bottled beverages varies widely, principally because of flavor requirements. Generally, according to Naarden (3), spoilage showed that the frequency of such occurrences is higher in drinks with a pH above 3.5 than with a pH below 3.0.

Higher temperatures result in shorter shelf life. Change of flavor is usually the first result of spoilage, followed by change of color. However, spoilage of bottled beverages does not usually constitute a serious problem because of the relatively rapid rate of turnover in the retail outlets which one beverage manufacturer states is within 1 week during the summer and 1 month in the winter (#25FIS).

Dry mixes are relatively stable when properly packaged and offer no serious problems of deterioration.

B. Coffee

Once the can has been opened and vacuum lost, the arrested staling cycle is activated. The beans absorb moisture, lose CO₂ and aroma volatiles, and become moderately stale in 1 week to quite stale in 3 weeks.

Instant coffee has been discussed with respect to yields. Having already lost much aroma during the extraction and drying processes, the product is less vulnerable to change by age or exposure. Aroma restoration is now common

practice, however, the newer products, especially freeze dried instant coffee, need some care in home storage. Consequently, covers should be replaced tightly once the can is opened as a protection against moisture absorption and caking since this product is subject to oxidation and staling. The danger of refrigerator storage is that coffee is highly hygroscopic and will attract moisture very readily when cold and exposed for spooning contents.

C. Tea

Flavor changes such as staling or reduction in aroma can occur and sometimes absorption of incompatible or foreign odors, such as from perfumed soap, takes place. Caking from moisture absorption can occur in instant tea. In very rare cases, there may be mold growth in liquid instant tea concentrates, but in general tea is one of the most stable of common foods and needs relatively little care during home storage other than keeping the container closed and in nonhumid areas. Experts can discriminate easily between samples that are fresh and those that have been stored for a long period, but most people find tea products very acceptable even when stored for 2 years. The tannins, caffeine, and sugars remain virtually unchanged during storage although aroma may decline in intensity and quality. Oxidation and moisture ultimately result in staling and mustiness but not in any health hazards.

An industrial source (#630FIS) states that,

"Items, such as instant coffee, instant tea, etc., are stored in regular warehouses in which the temperature may vary, but in which we require extremes to be avoided. Tea mix must be stored in humidity controlled spaces with a maximum relative humidity of 50%."

VII. PRESENT PRACTICES OF CODE DATING/PUBLIC DATING

A. Voluntary Food Industry Code Dating and Monitoring

Soft Drinks--Carbonated--Company #25FIS puts code, batch number, and coded manufacturing date on the carton instead of each bottle. Distributors of this manufacturer's products are localized and supplied from central syrup plants and not all of them maintain this code. The company's own trucks deliver beverages directly to retail stores. The company arranges for turnover once a week in summer months and once a month in winter months.

Coffee--Ground coffee is generally code-dated by embossing a cryptic code on the top or bottom of the can.

Company #30FIS openly dates its double-walled bags containing ground coffee, maintaining that time between plants and stores assures freshness, and removing unsold coffee from sale after 3 weeks from roasting date.

Company #530FIS practices are as follows: whole bean coffee has the expiry date printed on bottom of bag; coffee is removed from sale after that date. Vacuum-packed coffee has the day of production code dated on top cover by embossing for stock rotation. Instant coffee is code-dated on label for stock rotation.

Tea--All types of tea are code-dated for stock rotation. Instant tea is code-dated on the label for stock rotation.

Company #30FIS code dates all tea packages.

Company #565FIS provided the survey team with its procedural manual on remuneration precautions, monitoring methods, and retrieval procedures issued as instructions to sales personnel. The procedures cover: "General authority to pick up merchandise. . . .destruction of retrieved merchandise. . . .methods of reimbursements at pick up points, . . .stock rotation procedures," Some pertinent points follow:

"It is our company policy to remove all unsaleable or overage merchandise from dealer's shelves. However, it is our responsibility to do everything possible to prevent unsaleables. Specifically, unsaleables can be prevented through your attention to:

1. Proper rotation and merchandising, etc.
2. Intelligent planning and selling
3. Selective selling techniques.

"Unsaleable merchandise is extremely costly to all concerned and preventing it, wherever possible, will result in the company and the trade realizing maximum profit objectives.

"This procedure will not apply to merchandise rendered unsaleable through damage in shipment. . . . Regularly established Claim Procedure must be followed. . . .

"Pickups of overage merchandise in retail outlets will consist of relatively small quantities (less than full cases). Reimbursement for less than full case merchandise will be at retail price.

"Reimbursement for full unopened case merchandise will be made at list price for direct accounts and at wholesalers' price for indirect accounts.

"Unsaleable Merchandise Resulting from Fire, Flood, Riot, etc. . . .
Destruction of Merchandise

"Salesman picks up and destroys all unsaleable merchandise (unless more than 10 full, unopened cases are involved). It is not necessary to retain price spots, bottle caps, etc. as evidence of destruction or to have the destruction of unsaleable merchandise supervised by the Market Manager or Division Manager.

"It is the Salesman's direct responsibility to physically destroy unsaleable merchandise in order to prevent the unauthorized use or consumption of this merchandise. Failure to properly destroy unsaleable merchandise will probably require that we revert to the system that the Market Manager must supervise destruction.

"Note: Unsaleable merchandise must be removed from accounts once payment has been made and destroyed in accordance with this procedure. Any deviation from this requirement will result in immediate dismissal.

". . .Sales representatives are responsible for the stock rotation of our products in all chain, wholesale and retail accounts. Careful attention paid to this important sales function will eliminate over-age products caused by improper storage and handling. This is particularly true in the case of products which have relatively short shelf lives.

"To facilitate proper rotation of stocks, a special uniform code, indicating the date of manufacture is placed on both consumer packages and shipping cases of all our products.

"The code consists of one digit representing the year, a letter representing the month, and one or two digits representing the day of the month.

"In addition, letters will be used after the last digit but, since these letters are for production control purposes, they can be disregarded when considering over-age characteristics. . . .

"Products are over-age when the code dates indicate that a specified number of months have passed since production. . . .

"All merchandise which is found to be over-age will be destroyed in accordance with the authorization and procedures covering unsaleable merchandise. . . ."

B. Legal or Required Dating

1. Federal--There are no Federal requirements for public dating. The FDA regulations contained in the Federal Register, April 26, 1969, Good Manufacturing Practices, indicate that the FDA would like code dating in interstate and intrastate commerce shipments.

2. State--Connecticut requires an identifying number usually consisting of the abbreviation of CT followed by a plant number. This number must appear either as a part of the can code on the label of any non-alcoholic juice or beverage sold in Connecticut. This number identifies the location of the food processor's plant. Michigan and Minnesota require the listing of the city and State where nonalcoholic juice drinks and beverages are manufactured. If the packing firm's executive offices and processing plants are at the same location, only one address is required.

3. Municipal--No dating or coding requirements were noted.

4. Foreign--There are some requirements (see Legal Report, appendix II).

VIII. FOOD PRODUCT ITEM LIST

A. Shelf Life--Food Industry Sources (FIS)

<u>Food item</u>	<u>Time*</u>	<u>FIS No.</u>
Ades	12D	760
Apple cider	6-12M	800
Beverage mix	Indefinite	700
Beverage mix	2M	720
Carbonated beverages (glass)	6M	30
Carbonated beverages (cans)	6M	25
Chocolate drink	4-5D	130
Chocolate mix	Open: few M	130
	Unopen: 1Y	130
Cocoa	12M	30
Cocoa mix	9-12M	630
Coffee, whole bean (store)	21D	30
(home)	1W	30
Coffee, instant	1Y	630
Dry mix	15M	30
Drink mix, with sugar	12M	30
Egg nog	4-5D	130
Flavored drinks	12D	760
Fruit drink mix	1Y	630
Strawberry mix	12M	630
Tea	5Y	630
Tea, bags	18M	565
Tea, bags	12M	30
Tea, instant	indefinite	565
Tea, instant	12M	30
Tea, loose/carton	12M	30
Tea, mix	2Y	565
Tea, mix, iced	36M	565
Tea, mix, iced	12M	30
Tèa, packaged/carton	24M	565
Wine	1Y	100

*Y = year, M = month, W = week, D = day.

The following paragraphs contain additional remarks on the storage life of coffee or tea.

Depending on the efficiency of oxygen flushing during the vacuum-packing process, 9 months are regarded in the coffee trade as the maximum shelf life of unopened cans. Six-months turnover is better presale stock life to allow for home-storage time. Major name brands have turnovers of 2 months from packaging to sales. Vacuum-packed coffee is a splendid candidate for open-case coding to assure expedited rotation through all trade channels up to store shelf display. Date of shelf display is a means to assure more intelligent rotation within the consumer's home.

The unground roasted beans in double wall bags are expected to have up to 21 days of satisfactory store life. Thirty days have been found to be the limit for salability. After grinding in the home, the coffee is expected to be consumed within 1 week from purchase. Freshly ground coffee undergoes noticeable staling within a few hours. Seriously stale coffee flavor does not occur for a day or two depending on initial moisture and exposure (4). For unprotected coffee, the border of salability is reached between 7 and 14 days when the coffee may smell like cocoa and the brew taste bitter and rancid. Both the retailer and the consumer should be aware of these hazards of rapid deterioration. To assure understanding, some retailers open date their double wall bags for the consumers' benefit as well as for their own recall practice. If unsold after 3 weeks, the bags are removed from sale. Since delivery schedules after roasting are carefully regulated and open dating is practiced, there seems to be no need for legislative requirements of inventory coding or consumer dating in general. However, this selling practice is localized and in general in-store grinding has become rather limited. Roasted and ground coffee sold at retail is mostly packaged in "vacuum" cans, and instant coffee is packed in moisture-tight jars.

Instant coffee in unopened jars was considered to have a shelf life of up to 2 years. Today, much higher standards are sought, and quality manufacturers want the product to be consumed within 6 months of manufacture. Open-case coding for the trade and retail date stamping for the consumer are highly endorsed to assure consumer satisfaction.

Decaffeinated coffee, both bean and soluble types, are expected to have as long a shelf life as their regular undecaffeinated counterparts. Major companies are careful to practice first-in first-out stock rotation and to have field inspection of coded goods.

Industry source #565FIS stated that:

"Packaged (loose leaf) tea is regarded as over-age after 24 months if unsold. Tea bags are over-age after 18 months. Instant tea, packaged in hermetic jars and dried to low moisture content is regarded as being stable indefinitely. Flavored ice tea mixes (sometimes sweetened) made with instant tea have shelf lives limited by the flavor staling of the tea, but are generally regarded as satisfactory for 3 years. In no case are these aged products inedible nor do they constitute a danger to health."

"Our practice in the industry is to pick up for disposal over-age tea goods with compensation to the retailer. This is mainly to preserve good will of the consumer by providing identification of a quality image with the brand name."

IX. RECOMMENDATIONS ON BEST MEANS OF FOOD QUALITY MAINTENANCE

For reasons given in other sections, open dating is not recommended for any of these products.

To facilitate rotation by the retailer and to remind the consumer of the age of the home-stored tea, two general practices would be useful. The outer shipping case or cartons should have the date of manufacture and final packaging

for the benefit of warehouses, wholesalers, brokers, and retailers. The date of shelf display should be stamped on the individual retail units together with the retail outlet price.

Storage of the covered can of coffee in the refrigerator will retard staling rates appreciably, and such practice is apparently in wide use. It could be better publicized for new homemakers by marking cans conspicuously with instructions to "Close tightly and refrigerate after opening the sealed can."

Instant coffee and tea should have instructions by means of label suggestions for consumers to replace cap tightly as soon as required portions have been removed.

X. REFERENCES

- (1) Chain Store Age, 1969 Supermarket Sales Manual, Lebhar-Friedman, Inc., New York, N.Y., July 1969.
- (2) Personal communication, A.L. Henick, Natick Food Laboratories, U.S. Army Food Labs Division, Natick, Mass.
- (3) Naarden-Flavorex Inc., A Study of Beverage Shelf Life, 1967, pp. 3-14.
- (4) Sivetz, Michael, and Foote, Elliot H., Coffee Processing Technology, Vol. I, The Avi Publishing Company, Inc., Westport, Conn., 1963.

DRY FOODS

I. INTRODUCTORY REMARKS

This dry food grouping includes three product groups: (A) breakfast foods; (B) macaroni/pasta; and (C) dehydrated vegetables, fruits, and soups.

As a major department, dry foods constitute 3.02 percent of the total sales of the items sold in supermarkets. They span the regular plan of the three main meals a day and are eaten both hot and cold. Product groups (A) and (B) are in the category of carbohydrate sources which may be fortified with added nutrients. Product group (C) can be considered as carbohydrate with natural mineral nutrients, although fortification for supplementation of diets is possible. The report format is not strictly adhered to here, but the main points of interest for this survey are included, except for the following: Section II. SUMMARY OF RECOMMENDATIONS: Section III. TYPE OF FOOD AND PRODUCT GROUP: Section VII. PRESENT PRACTICES OF CODE DATING/PUBLIC DATING, Sub-section B. Legal or Required Dating for Product Group (A) contains data for (B) and (C) which follow; Section X. REFERENCES for (A) and (B) are presented after (C).

II. SUMMARY OF RECOMMENDATIONS (see also section IX of (A), (B), and (C) which contains recommendations for all the products in this department)

A. Adoption by the New Jersey Department of Health of the coding recommendations of the FDA Good Manufacturing Practices, Federal Register, April 26, 1969, for processed foods. Disclosure of code meanings by food manufacturers to the New Jersey Department of Health on request by the latter.

B. Adoption of date of manufacture labeling on all outer cases/overwraps, etc., to assist in stock rotation.

C. Voluntary coding of all individual containers in such cases/overwraps by the food industry with codes of its own choosing (similar in intent to A. above). These codes should indicate plant location, date of manufacture (of final product in container), shift, production line, and any other product aspects, at the manufacturer's discretion.

D. Stamping of date of shelf display by retail stores for stock rotation and as a consumer aid in home-storage stock rotation.

E. Expansion of instructions for consumer's use and storage. One suggestion would be the instruction, "Do not store in hot humid areas" versus "Store in cool, dry place." These products should be stored in a sealed container after opening if not all used at one time to prevent possible insect infestation.

III. TYPE OF FOOD AND PRODUCT GROUPS

Dry foods, by product group, category, and variety

Product group	Percent- age of total sales	Product category	Percent- age of category sales	Percent- age of total sales	Product variety	Percent- age of depart- ment sales	Percent- age of total sales
Breakfast foods	1.69	Ready-to eat cereals	65.9	1.114			
					Sweetened	20.7	.350
					Hi-protein	6.5	.110
					Corn flakes	6.4	.108
					Bran and wheat germ	5.4	.091
					Cold oat	5.0	.085
					Wheat flakes	4.0	.068
					Combo. packs	3.7	.063
					Shredded wheat	2.5	.042
					Puffed rice, wheat and oat	2.1	.035
					All other ready-to-eat cereals	9.6	.162
						65.9	1.114
		Milk beverages	17.0	.287			
					Instant breakfast	6.8	.115
					Milk add. and cereal bev. (dry)	6.7	.113
					Milk add. bev. (syrops)	2.5	.042
					Cocoa mixes	1.0	.017
						17.0	.287
		Hot cereals	11.3	.191			
					Oat	6.7	.113
					Wheat	3.1	.053
					Hominy grits	.6	.010
					All other hot cereals	.9	.015
						11.3	.191

Source: Chain Store Age, 1969 Supermarket Sales Manual (1), Lebhar-Friedman, Inc., New York, N.Y., July 1969. Used with permission of the publisher.

Dry foods, by product group, category, and variety--Continued

Product group	Percent- age of total sales	Product category	Percent- age of category sales	Percent- age of total sales	Product variety	Percent- age of depart- ment sales	Percent- age of total sales
Breakfast foods (Continued)		Toaster pastries	5.8	.098			
					Regular Frosted and other	4.3 <u>1.5</u> 5.8	.073 <u>.025</u> .098
			100.0	1.690			
Macaroni/ pasta	.61	Macaroni	32.3	.197			
					Elbow Other	12.3 <u>20.0</u> 32.3	.075 <u>.122</u> .197
		Spaghetti	28.2	.172			
					Regular Flat (linguine)	25.8 <u>2.4</u> 28.2	.157 <u>.015</u> .172
		Noodles	15.9	.097			
					Flat Other	14.6 <u>1.3</u> 15.9	.089 <u>.008</u> .097
		Macaroni dinners	8.2	.051			
					With cheese Other	5.0 <u>3.2</u> 8.2	.031 <u>.020</u> .051
		Noodle dinners	7.1	.043			
					With meat Other	3.7 <u>3.4</u> 7.1	.023 <u>.020</u> .043
		Spaghetti dinners	3.4	.021			
					With meat Other	2.4 <u>1.0</u> 3.4	.015 <u>.006</u> .021
		All other pasta dinners	.2	.001			
		Pizza mix	4.7	.029			
			100.0	.611			

Dry foods, by product group, category, and variety--Continued

Product group	Percent- age of total sales	Product category	Percent- age of category sales	Percent- age of total sales	Product variety	Percent- age of depart- ment sales	Percent- age of total sales
Vegetables	.39	Rice and rice dishes	53.9	.210			
					Plain white, reg.	28.0	.109
					Plain white, quick-cooking	14.0	.055
					Rice dinner mixes	7.5	.029
					Other special and flavored rice	4.4	.017
						<u>53.9</u>	<u>.210</u>
		Instant potatoes	25.1	.097			
					Mashed	20.9	.081
					Other	4.2	.016
						<u>25.1</u>	<u>.097</u>
		Beans	18.0	.070			
		Peas	2.4	.009			
		All other dried veg- etables	.6	.002			
			<u>100.0</u>	<u>.388</u>			
Fruits	.23	Raisins	47.8	.110			
		Prunes	30.3	.070			
					Regular	20.2	.046
					Pitted and other	10.1	.024
						<u>30.3</u>	<u>.070</u>
		Dates	7.8	.018			
		Apricots	7.1	.016			
		All other dried fruit	7.0	.016			
			<u>100.0</u>	<u>.230</u>			
Soups	.10	Dry soup mixes	78.1	.101			
					Noodle	36.7	.048
					Onion	25.0	.032
					All other mixes	16.4	.021
						<u>78.1</u>	<u>.101</u>

(A) Breakfast Foods

III. TYPE OF FOOD AND PRODUCT GROUPS

This product group constituted 1.69 percent of supermarket sales in 1968, according to Chain Store Age; 65.9 percent of this group consisted of ready-to-eat cereals, 17.0 percent were milk beverages, 11.3 percent were hot cereals, and 5.8 percent were toaster pastries.

The ready-to-eat cereals category includes a wide diversity of varieties such as flaked, granular, puffed, shredded, and varieties from dough.

The milk beverages are relatively new as a category and are usually either canned or dried and sold in packages.

The hot cereals, such as oatmeal, farina, and hominy grits, are generally available in quick cooking, precooked, or instant form. Toaster pastries are newcomers to the breakfast cereal line.

IV. TYPE OF PROCESSING AND PRESERVATION

The basic principles of processing are those of mixing (wet or dry) followed by dehydration.

The flaked cereals are generally made from one or more grains by some cooking process using steam or hot water or both. Flaking is usually done by pressing between various types of rollers, followed by drying and toasting. A wide assortment of flavors may be added, including sugar, salt, malt syrup, and honey. Some cereals are fortified with more vitamins and minerals.

The puffed-type cereals are made by a modified cooking procedure which takes place inside a pressure chamber or gun. Puffing of the grains or other particles occurs when the gun is suddenly opened, internal pressure is released, and the grains suddenly swell. Some drying or toasting or both may be done just before packaging.

A wide variety of ready-to-eat cereals is made from doughs prepared from starchy farina-like materials originally obtained from the basic carbohydrate source grains. The aforementioned puffing process is being used more frequently in making these cereals.

Shredded products, such as shredded wheat, require cooking of the grains under pressure to swell the grains to the desired degree, after which they are formed into strands by pressing between rollers. Many shapes may be formed in this fashion. The formed biscuits are baked, cooled, and packed.

Granular products are usually formed into a very dense type of bread which is baked, then granulated, redried, sieved for uniformity of size, and packed.

All of the foregoing ready-to-eat cereals have a moisture content of less than 10 percent, and further preservation depends on retention of this low-water level to maintain a desirable crispness. They are usually packed in cartons with sealed waxed paper liners.

Milk beverages are generally similar to other products discussed under canned goods and dry mixes. They are of lower moisture content and require special packaging in polyethylene foil laminated pouches. Some are also wrapped in laminated paper outers which permit printing and sale of individually portioned packets.

Hot cereals are usually made from oats, wheat, corn, or rice by rolling or pressing the kernels into flakes or granules without subsequent toasting. Some products are also precooked to instantize them and subsequently dried so that they appear in about the same form as untreated cereals. They are normally packaged in printed, plain paperboard boxes which are tightly sealed to prevent infestation by insects.

Toaster pastries are produced in a manner similar to products described under the heading of bakery products, and are packaged in polyethylene foil pouches in outer paperboard boxes.

V. QUALITY CHARACTERISTICS

The ready-to-eat cereals must be maintained at a low enough moisture content to preserve their crispness. This feature is an aesthetic-textural characteristic normally required of these products. Various flavors have become associated with specific categories, varieties, and brand items. These products contain low amounts of natural oils which may become rancid and offend the taste and flavor. The resulting toxicity or public health hazards are self-limiting since levels of rancidity required to produce toxicity would require consumption of large quantities of partially putrified products.

According to the Cereal Institute 1/:

"Nutritionists consider ready-to-eat and hot cereals to be excellent sources of the B vitamins thiamine and niacin and iron. Responding to national nutrition needs recognized in 1943, cereal manufacturers voluntarily restored these nutrients to the grain in breakfast cereals to insure that most products contained whole grain levels of these nutrients. Some newer cereals, developed since 1955, provide even more of these and other essential nutrients than are present in the whole grains.

"Today's breakfast cereals are nutritionally classified by the Cereal Institute as:

Whole Grain - those in which the grain provides thiamine,
or Restored niacin and iron in amounts present in the
original grain.

1/ The Cereal Institute, Inc., 135 South LaSalle St., Chicago, Ill. Used with permission of the Cereal Institute.

High Vitamin - those in which a one ounce serving provides 1/3 or more of an adult's Minimum Daily Requirements (MDR). Some contain 100% of the adult's MDR.

(Minimum Daily Requirement, established by the Food and Drug Administration, is an expression of the minimum quantity of a nutrient needed daily to maintain good health.)

High Protein - those which contain substantially more protein than the 6 to 10% found in many breakfast cereals.

"In addition to calling attention to the brand name, cereal packages communicate important nutrition information about individual products. The Food and Drug Administration has specific regulations requiring the listing of ingredients and added nutrients. Package nutritional statements are continually subject to monitoring by this government agency. Protein, fat and carbohydrate contents are frequently given as well as the number of calories per ounce of cereal.

"Cereal quality begins with the selection of grains, flavorings, vitamins and minerals used in producing a cereal. To insure a finished product that is consistent in quality and nutritional value, suppliers of raw materials are required to certify that each shipment meets the standards required by each cereal manufacturer. As a double check, cereal companies' quality control departments run their own periodic quality checks on all raw materials and inspect the manufacturing facilities of suppliers.

"Quality is monitored throughout the entire cereal manufacturing process. Ingredients must be mixed according to a precise predetermined formula or "recipe". Cooking times and temperatures must not vary so that a uniform, appealing product is produced. The color, crispness, size, and shape of the cereal is noted during key processing steps and if variations occur, necessary adjustments are made.

"The quantity of vitamins, minerals and other nutrients is continually checked to be sure proper amounts are being added. Characteristics of these individual nutrients determine when and how they are applied to the cereal. Nutrients stable to heat are usually added in the blending of raw materials or during the cooking of the grains. Heat sensitive vitamins are applied to the cereal during one of the last processing steps so that these vitamins retain their effectiveness.

"Analyses are made of finished cereals to assure nutrients will be present in the amounts stated in the package during the period normally required for the product to be consumed in the home."

VI. PROCESSING AND STORAGE QUALITY LOSS FACTORS

A. Identification of Potential Causes of Quality Losses

In addition to normal nutritional losses occurring during cleaning and refining of grains, there may be losses of thiamine in products subjected to

high temperature during processing. Many cereals have vitamins and minerals added to restore those lost during milling and other processing operations. Others are fortified to give additional enrichment.

Ready-to eat cereals tend to become stale or rancid during storage. To retard such spoilage, antioxidants such as butylated hydroxyanisole and propylgallate are added. However, the rate of development of rancidity increases with increased storage temperature so that shelf life is dependent on storage conditions.

If ready-to-eat cereals are subject to humid conditions, they absorb moisture and become soft, losing consumer appeal and palatability. For this reason they are generally packaged in paperboard cartons with inner waxed pouches. These products, however, may readily become limp once the package has been opened for home storage.

The cooked cereals are subject to insect infestation after the package has been opened for home use. This is more likely to occur during summer weather when insect life is more active at the higher prevailing temperatures. This occurrence is unpredictable and is not directly related to shelf life. With increasing industrial and FDA emphasis on sanitary practices, there is little likelihood for such infestation when the product is packed and sealed, but on retail shelves and in home storage this occurrence is still possible.

B. Food Industry Practices for Quality Maintenance

The practices of the food industry to maintain quality and control deteriorating factors reflect its awareness of the difficulties encountered in these product categories. An industrial source (#721FIS) stated in this respect:

"Quality is composed of many aspects which include, but are not limited by, color, texture, nutrition, organoleptic evaluation, flavors, etc. To this end we do extensive testing on our raw materials as received in our producing plants and when marketing a new product we do establish maximum warehouse times and shelf life for the products prior to release to the trade."

C. Channels of Distribution

- (1) Transportation
- (2) Warehousing and storage display
- (3) Retailing--storage and display

No industrial information on this subject was available at the time of this writing.

D. Consumer Factors

Some consumer factors were discussed in previous sections. Most industry producers give instructions for home storage on food containers.

VII. PRESENT PRACTICES OF CODE DATING/PUBLIC DATING

A. Voluntary Food Industry Code Dating and Monitoring

Company #505FIS codes its products in the following manner.

"1. Family size cartons

"A one or two digit number indicates month of production, followed in most cases by alphabetic characters indicating the location of the production plant. The size of print is 3/16".

"2. Individual portion size cartons

"A two or three digit numeral indicates month and year packed. An additional color code denotes the type of wax paper liner used. This presumably allows shipment of the product to the various geographical locations dependent on the temperature and climate involved. A digit indicating the year is necessary on these because the cartons contain no promotional printing, which changes on the family size from time to time, permitting identification of the year of production."

The above codes are used on all items with a shelf life of 6 months or more.

Company #360FIS codes its products with letters and numerals to indicate day, month, and year of production and plant location.

Company #530FIS codes these products with day of production for purposes of shelf rotation. This policy is used for products which are "the longer shelf-life products."

"Insofar as our cereals are concerned, these are in fiber boxes with paper labels and we have arbitrarily set a maximum shelf life of one year on these and our salesmen pick the products up if they exceed this age in the market."

No company openly or publicly dates its products for any purpose in this product group.

B. Legal or Required Dating

1. Federal--With the exception of the FDA Good Manufacturing Practices of the Federal Register, April 26, 1969, there is no coding requirement for this product group. The same applies to the other product groups, (B) and (C), listed in the main introductory remarks in section I.

2. State and (3) Municipal--There are no requirements for code dating or public dating of this product group or of other product groups, (B) and (C), listed in section I.

4. Foreign--Code dating or public dating of product groups (A), (B), and (C) are required in certain foreign countries (see Appendix II of the Legal Report).

C. How Dating Influences Quality Maintenance: Advantages and Disadvantages of Dating

The product varieties of breakfast foods are fast moving items in retail stores. They are starch products designed to have shelf lives of at least 1 year or more. None of the products are in categories of possible health hazard nature, except for milk beverages which sometimes pose a problem of salmonella organisms. However, this can be prevented by microbiological quality control. Dating could not control this occurrence. As in other foods code dating by the food industry, including implementation of monitoring, is common procedure. As noted earlier, the food industry is aware of the factors influencing shelf life (e.g., temperature), and tries to control them. Packaging is a good illustration of this adjustability. For example, the type of wax used for coating inner liners changes in melting point depending on local climates. Consequently, a higher melting point wax (130°F.) is used for the southern United States, with its higher temperatures, than for the northern United States. Some of the above procedures are more instrumental in controlling quality loss in storage than dating.

VIII. FOOD PRODUCT ITEM LIST

A. Shelf Life--Food Industry Sources (FIS)

<u>Food Item</u>	<u>Time*</u>	<u>FIS No.</u>
Cereal	6M+	505
Cereal, dry	6M	470
Cereal, ready-to-eat	6-8M	360
Macaroni	6-8M	490
Macaroni	6-8M	420
Macaroni	Indefinite	610
Macaroni dinner	5M	30
Macaroni dinner (tin)	12M	30
Noodles	9M	30
Noodles, egg	9M	610
Pasta	6-8M	420
Pasta, casserole mix	1Y	360
Spaghetti	Indefinite	610
Spaghetti	9M	30
Spaghetti	12M	30
Potato, casserole mix	1Y	360
Potato, dehydrated	10M	360
Rice	Several years	725
Rice	1Y+	920
Rice, casserole mix	1Y	360
Rice mix	1Y+	920

*Y = year; M = month; W = week, D = day.

<u>Food item</u>	<u>Time</u>	<u>FIS No.</u>
Soup mix	1Y+	565
Dry foods (general)	4M-1Y	722
Dry foods (general)	6W	350
Dairy products	1Y	170
Dehydrated gravy mix	300-360D	520
Dehydrated seasoning mix	360D	520
Dehydrated sauces	180-360D	520

Company #505FIS reports that the shelf life of its ready-to-eat cereals is over 6 months.

Company #470FIS, a precooked baby food cereal manufacturer, stated, "Dry cereal products we do not recommend being kept in the home longer than a six-month period."

Company #360FIS reported that its ready-to-eat cereals have a shelf life of 6-8 months. This is based on weather conditions prevailing in the northern half of the United States. This company believes the shelf life in the South is 1-2 months shorter.

IX. RECOMMENDATIONS ON BEST MEANS OF FOOD QUALITY MAINTENANCE

Since several major companies are currently coding their packages of cereals, it is recommended that other companies adopt this practice.

To encourage and assist in shelf rotation of stock, all cases or outer wraps should be open dated (day, month, and year) with the date of production.

It is also recommended that retailers mark all breakfast cereal products with date of shelf display to aid in stock rotation.

Open code dating is not recommended because any termination of shelf life is dependent on storage conditions. Abuse of products by exposure to high temperatures for extended periods could terminate acceptability long before any stated safety time dating. When storage temperatures are controlled, expiry dating could become regular practice.

X. REFERENCES

References for this section are included at the end of product group (C).

(B) Macaroni/Pasta

I. INTRODUCTORY REMARKS and III. TYPE OF FOOD AND PRODUCT GROUPS

Pasta products have grown from an ethnic line with large import volume to a domestic industry with appeal to the general population. Their acceptance has paralleled the boom in convenience foods because of their ease of cooking and low cost. They are commonly utilized in dry soup mixes, as major components of "dinners," "main dishes," casserole combinations, and in canned and frozen products.

The major significance of pasta in the diet is as a carbohydrate base. It is often consumed as a substitute for bread, potatoes, or rice. As a separate raw material, pasta sales in supermarkets in 1968 amounted to 0.61 percent of total sales volume, but probably this represents only 50 percent of sales since it does not account for ingredients consumed in the combination products. This section, however, is mainly concerned with dry, separate ingredients rather than compositional meals.

IV. TYPE OF PROCESSING AND PRESERVATION

The basic principles involved in making macaroni/pasta are the production of a preformed, preshaped, partially cooked dough by mixing flour and water, and the dehydrating of the mixture for regenerative use by cooking in water at a later time by the consumer.

Pasta consists of wheat flour, usually special durums and semolina, which are made into tough doughs with added water (28-32 percent total moisture) and extruded in the dough form through presses or roller mills, after which it is cut and dried to not greater than 13 percent moisture. Flour and water are the only required ingredients of macaroni and spaghetti. Enrichment, now a common U.S. practice, may include such ingredients as thiamine, riboflavin, niacin, iron, vitamin D, calcium, and sometimes wheatgerm. FDA standards of identity permit several optional ingredients such as egg white, seasoning, salt, and supplementary wheat gluten which raise the protein content. Noodles by U.S. Federal definition contain not less than 5.5 percent of whole egg or egg yolk solids on a finished-product basis. The rich yellow color of noodles is the result of the egg yolk.

Pastas are added as ingredients to other meals and further processed by canning, cooking, and freezing to make complete main dinner dishes.

V. QUALITY CHARACTERISTICS and VI. PROCESSING AND STORAGE QUALITY LOSS FACTORS

A. Quality

The main quality attributes of this product group are aesthetic--color and texture. Textural changes occur when the dry product "crazes," causing it to shatter on cooking. Other aesthetic changes are flavor absorption from the

packaging material and staling. Nutritional value does not appear to suffer seriously and there is no public health hazard. Insect infestation from outside the package is not uncommon in the home when partially used packages are not resealed tightly. Insect infestation used to be a common industrial complaint, but in-plant sanitation of the flour milling process has reduced this type of spoilage.

The stability characteristics are of greater durability than those of bread or potatoes in home storage and, in some respects, pastas change less in storage than does rice. This stability is partly attributable to its low (1 percent) fat content, and to the product's density which tends to reduce oxidative changes.

B. Food Industry Practices for Quality Maintenance

Insect infestation, which used to be a problem common to all starchy types of food, has been practically eliminated through strict plant sanitation and better package design. The type of packaging used also helps to control humidity and exclude light--factors affecting stability.

One food company (#730FIS) stated, "Macaroni products, since they are made from wheat, are highly hygroscopic and can be affected if subjected to storage under conditions of high relative humidity."

C. Channels of Distribution

The food industry is aware that it must protect its products in all channels of distribution. One member (#730FIS) stated:

"Although we do not have fact sheets, we inform all dealers who handle our products that macaroni, spaghetti, and noodles should be maintained in a cool, dry place, with proper rotation of stock. In addition to instructions to dealers through sales representatives and printed notices on shipping containers, we are most careful in maintaining good manufacturing procedures and a high level of sanitation at our factory."

Another food industry source (#420FIS) stated:

"Shelf life of macaroni and noodles can be as long as 6 to 8 months assuming that the humidity in the store does not exceed a reasonable amount. Most of the chain stores today are air-conditioned and the humidity is kept rather low. This is not the case in the smaller stores such as some independents, and for that reason the shelf life might be limited to as little as 2 to 3 months. With respect to our baked products such as matzos, the shelf life is approximately the same because they are over-wrapped with wax paper which provides more protection...."

Another industry source (#610FIS) stated:

"Shelf life for macaroni and spaghetti products is almost indefinite provided they are stored in a cool dry place. For noodles the life span ranges from nine months or a bit longer provided that they, too, are kept in a cool, dry place."

VIII. FOOD PRODUCT ITEM LIST

A. Shelf Life--Food Industry Sources

Company #490FIS wrote:

"In regard to the shelf life of macaroni products, it is our opinion based on many years of experience, that the shelf life can be as long as 6 to 8 months depending upon storage conditions."

Producer #420FIS reported:

"Shelf life of macaroni and noodles can be as long as 6 to 8 months assuming that the humidity in the store does not exceed a reasonable amount. Most of the chain stores today are air-conditioned and the humidity is kept rather low. This is not the case in the smaller stores, such as some independents, and for that reason the shelf life might be limited to as little as 2 to 3 months. With respect to baked products such as matzos, the shelf life is approximately the same because they are over-wrapped with wax paper which provides more protection. However, changes do take place and as any product of this type can get stale. This occurs also after 6 to 8 months."

When pasta is part of mixes or canned foods, it has a much longer shelf life than when packaged separately. Fifteen and 18 months are typical durability times for the former. Shelf life terminates principally because of flavor fading and changes in ingredients other than the pasta. More costly and protective packaging is typical, and there is an interplay of moisture equilibration and antioxidant effects with other ingredients which serves to preserve the freshness of the pasta.

IX. RECOMMENDATIONS ON BEST MEANS OF FOOD QUALITY MAINTENANCE

Date of shelf display on pasta products is recommended because it gives storage information to consumers and thereby promotes turnover of the products in the home. Pasta (like prunes, raisins, flour, and sugar) is often stored for long periods, reducing its capability of performance with satisfactory organoleptic cooked qualities. Storage at home in nonhumid, cool locations promotes stability and should be indicated on food labels and consumer education programs.

X. REFERENCES

References for this product group are included at the end of product group (C).

(C) Dehydrated Vegetables, Fruits, and Soups

1. Dehydrated Vegetables Category--Dehydration has several objectives, but for retail products the factors of convenience, lowered weight and volume, and preservation are predominant.

The principal dehydrated vegetables on the market shelves are rice, potatoes, beans, peas, onions, tomatoes, garlic, and parsley in approximately this order of importance. Dehydrated peas have had good retail acceptance in many foreign countries (usually where home refrigeration is uncommon) but have been less accepted in the United States because of the convenience, quality, and low cost of frozen peas.

Mushrooms, especially freeze dried, have been offered in the retail market without conspicuous success. Mushrooms and other dehydrated vegetables have had good sales growth as ingredients in manufactured products such as soup mixes, canned foods, dry or fluid salad dressing products, and cottage cheese. In addition to the vegetables already named, the main ones sold primarily to manufacturers or institutional users are carrots, celery, bell peppers, green beans, and cabbage. Of lesser volume are beets, asparagus, navy or kidney beans, horseradish, pimiento, and spinach.

II. SUMMARY OF RECOMMENDATIONS--See section II in product group (A) above.

III. TYPE OF FOOD AND PRODUCT GROUP--See section III in product group (A) above.

IV. TYPE OF PROCESSING AND PRESERVATION

The basis of preservation of dehydrated foods is the reduction of moisture content to levels below which microorganisms can act to spoil the food.

Methods of manufacturing dehydrated vegetables vary greatly, with each vegetable virtually requiring a customized method. Each form of product within a vegetable variety requires a different process flow sheet. For example, there are many potato dehydration processing methods, depending on whether pieces or powder are to be made. Instant potato powder may be made from potato mash by a granule process or a flake method, each one so different from the other that plants producing these products usually specialize in only one of the two methods. Dehydration methodology can define properties of special character and determine product end use. For very rapid rehydration, some vegetables are freeze dried and some are puff dried. Strained vegetable purees can be drum dried or spray dried (e.g., tomato, split peas). The most versatile drying processes are those of truck-and-tunnel drying (on trays) and continuous belt drying, followed in each case by bin drying with dehumidified air.

Most dehydrated vegetables are made with antioxidants or antibrowning additive agents. With few exceptions (such as onion, garlic, rice, split peas, and lima beans), sulfiting with sulfur dioxide or sodium sulfite salts is

common practice. Packing in an inert atmosphere, nitrogen, has been found to be useful for bulk storage in advance of packing at the factory and sometimes is used in the retail package. Butylated hydroxy anisole, butylated hydroxy toluene, citric acid, ascorbic acid, propylgallate, and sorbates are often used at low levels and declared on package labels. Pesticide residues are tested for and are related to field practices. Most large dehydrators have programed crop spraying or dusting which they require of contract growers and which are designed to assure reduction to minimum residue levels before harvest. Thereafter, plant processing such as peeling, washing, blanching, or cooking further reduces residues.

Bacteriological control is a significant factor in the manufacture of dehydrated vegetables. Rapid processing, sanitary equipment, minimum handling by personnel, use of surface washing agents, chlorination of wash water, and sulfiting are among the numerous measures employed. Nevertheless, many dehydrated vegetables are not sterile or even pasteurized and can have appreciable counts of microbiological populations. Pathogenic bacteria are rare. The quality control bacteriologists in laboratories of producers and remanufacturers follow each lot of product. Fortunately, from public health and stability standpoints, the counts of bacteria tend to decline with storage, and home cooking is a further important sanitizing measure.

V. QUALITY CHARACTERISTICS

Dehydrated vegetables cannot claim major nutritional values such as their fresh, frozen, or canned counterparts. However, in certain cases, such as split peas, quick-cooking rice, potatoes, and beans, they provide considerable caloric nourishment. Their principal attributes are convenience, flavor, texture, attractiveness of color and appearance, and sometimes mineral contents. Long stability is associated with this class of foods. This association (as with spices, skim milk powder, flour, sugar, salt, and certain other "staples") inspires overconfidence in home stability. Some or all of these products will decline in freshness, flavor, and color; rancidity and staling are probable with overlong storage. However, functional properties (rehydratability and cooked texture) endure exceptionally well, and there is no known health hazard. Infestation, though highly uncommon, is an economic hazard in home storage. Browning can occur with vegetables if sulfite content declines or if moisture pickup occurs.

There are degrees of perishability in this class of foods. Potato and rice can suffer over extended time periods, especially from staling, rancidity, and infestation of opened, partially used packages.

VI. PROCESSING AND STORAGE QUALITY LOSS FACTORS

These factors have been discussed in (IV) and (V) above, as have the common industrial means for prevention and quality maintenance.

A rice producer (#920FIS) stated:

"For your information these are all dry products which are quite stable, having a shelf life in excess of one year in all cases. The

storage recommendations are simply to keep the products in a dry, clean place and not expose them to unreasonably hot temperatures. They do not have to be refrigerated but are stable under normal household pantry conditions as well as normal conditions in the commercial channels of distribution.

"To answer your specific questions, by 'dry' we mean a relative humidity of less than 60% and 'unreasonably hot temperatures' would be in excess of 90 degrees Fahrenheit."

Another manufacturer (#730FIS) of the same product stated:

"Rice products, including various forms of white rice and brown rice, have indefinite shelf lives. If stored properly in 'breathing' containers and protected from infestation and extreme temperature fluctuations, rice may be maintained for long periods of time. Brown rice, however, because of its slightly higher fat content, may become somewhat rancid in odor and flavor, a fact which would not render it inedible."

VII. PRESENT PRACTICES OF CODE DATING/PUBLIC DATING

A. Voluntary Food Industry Code Dating and Monitoring

The industry codes its products and monitors them in retail outlets.

B. Legal or Required Dating

See subsections 1-4 in product group (A) above.

C. How Dating Influences Quality Maintenance: Advantages and Disadvantages of Dating

In this product category, production and packaging practices are of greater importance in quality maintenance than dating practices.

VIII. FOOD PRODUCT ITEM LIST

See this section in product group (A) above.

2. Dehydrated Fruits Category--Much of what has been presented about dehydrated vegetables applies to dehydrated fruits. Sun-drying has been progressively replaced by machine dehydrators for prunes, apples, figs, and bleached raisins, but regular raisins, apricots, peaches, and pears still are sun-dried. Sun-dried fruits constitute about half the dried fruit tonnage in the United States. Fruit juice powders, of course, are always processed by drying machines. Dried fruits, used mainly in bakery products and compotes, are an important international agricultural commodity. Military field rations rely on the high-caloric value and the low-weight and volume features of dried fruits.

This survey is not concerned with the relative sanitary control features of sun-drying versus interior dehydration. Opportunities for environmental contaminations are obvious in the former method (birds, vermin, insects, dust, etc.). Quality control surveillance requires Government and manufacturer technicians to guard against "extraneous matter."

Kiln dryers, cabinet dryers, and tunnels with trucks and trays are conventional dehydrators for fruits. Freeze dryers have been used for drying strawberries, bananas, and blueberries to mix with breakfast cereals. Continuous belt conveyor dryers are used for apple slices and shredded coconuts. Drum dryers are used for drying banana puree and sweet potato "mash."

Fumigation with methyl bromide is not uncommon to prevent insect infestation during storage and before packaging. In addition to possible fumigation, antimycotic agents or fungistats are used to stabilize moist prunes and figs (30 to 35 percent moisture content) against mold growth. Sorbic acid and sorbate salts are used in dips or sprays. Sulfur dioxide or sulfite salts are used to preserve fruits during drying from color changes and browning. Storage of products at semitropical or summer temperatures requires residual sulfite to prevent darkening and flavor bittering, and to make the dried fruit a less favorable medium for growth of microorganisms. Ionizing radiation will be a boon in preventing growth when such sterilizing practice is permitted and adopted.

There are considerable data that correlate keeping quality of dried fruits with temperature. Typically, the storage life at 70°F. is about four times the life at 90°F. Darkening and loss of flavor are the major types of deterioration. A 1961 USDA report (2) on fruit samples taken from many retail markets showed that 7 percent of the raisin and 17 percent of the fig samples had deteriorated to the undesirable quality level. Loss of sulfur dioxide during holding has been correlated with such deterioration. Several groups of researchers have found that a 65 to 75 percent loss of sulfur dioxide corresponded to color deterioration (darkening) denoting the end of acceptability. Copley and Van Arsdel (3) stated: (Used with permission of The Avi Publishing Co., Inc.)

"The flavor of processed dehydrated fruits is noticeably affected by increased temperatures in storage. These changes can be detected by taste panel tests. Nury (1962) has shown that processed retail packages of raisins can be distinguished as significantly different in flavor from the control after 16, 14, [and] 9 weeks at 50°, 70°, [and] 90°F., and processed dried figs stored at 50°, 70° and 90°F., can be distinguished from the control after 56, 40, and 9 weeks. These results do not tell when the flavor changes are so extensive as to adversely affect acceptance and sales. They indicate the times at which stored products can first be distinguished from the control. As can be seen in [table 13] (Nury, 1962), first discernible changes in color appear considerably before the first discernible changes in flavor."

The following measures should be adopted:

- (1) All cases should be open-dated, in English, to promote better stock rotation.

Table 13.--Flavor and color changes in dried fruit stored at 50°, 70°, and 90°F.

Storage temperature (°F.)	Raisins		Figs		Prunes	
	Color	Flavor	Color	Flavor	Color	Flavor
	-----Weeks 1/-----					
50	8-10	16-18	<6	56-60	---	60-65
70	2-4	14-16	2-4	40-42	8-10	48-50
90	1-2	9-10	1	9-10	4-5	9-10

1/ Weeks before detectable color and flavor changes take place.

Source: Adapted from M. J. Copley and W. B. Van Arsdel, Food Dehydration, Vol. II, The Avi Publishing Co., Inc., Westport, Conn. (3). Used with permission of the publisher.

(2) The date of shelf display should be stamped at the time of price stamping.

3. Dehydrated Soups and Other Dry Mixes Category--Dry staple foods and certain dry vegetables have traditionally served as ingredients in home-cooked soups. The leading varieties of dry soup mixes are chicken noodle and onion. Vegetable, pea, mushroom, tomato, beef, and rice are both individual soup varieties and combinations, such as chicken-rice, tomato-vegetable, beef-noodle, and vegetable-beef.

All ingredients of dry soup mixes must be low enough in moisture content to ensure that reactions causing changes in color and flavor are inhibited. These reactions are mainly enzymic (especially in the case of vegetables) or nonenzymic browning, where the amino acids or proteins combine with monosaccharide sugars or functional groups of aldehydes and ketones. This latter browning reaction causes caramel-like flavor and color formation usually with release of some formed moisture which may worsen the deterioration further and cause product caking. The enzymic reactions are retarded or prevented by the heat processing these products receive. A highly specialized technology has had to be developed to assure good keeping quality. Two-dimensional pouches are used with wall structures of aluminum foil laminated between paper and plastic films. Though flexible and heat-sealable, this structure must be puncture resistant and impervious to moisture penetration. With this type of packaging, a knowledge of equilibrium relative humidity was developed which related moisture level to mutual protection against browning, staling, and rancidity. The significance of carbohydrate materials (pasta, flour, etc.) as "moisture sinks" was discovered which introduced subnormal moisture levels to equilibrate and absorb surplus moisture that otherwise might promote deteriorative changes in the other sensitive ingredients (4). With the exception of dehydrated onions, several vegetables require sulfiting or other special

treatments (e.g., starch coating of carrots) to prevent browning, color fading, and flavor staling. Bacteriological control is vital, since vegetables are natural carriers of soil contaminants. Storage in low-moisture conditions is not conducive to microbial growth and often results in lowering of counts. Home cooking is relied upon to effect final sanitizing before consumption, as is the case with frozen produce.

Meats in various dried forms are important ingredients in dry mixes for nutrition, flavor, and texture. These forms vary from water-soluble beef extract and chicken broth solids to powdered chicken meat or beef, and to chunks or dice. Spray drying and drum drying are typical methods of drying the powders. Air tunnel or tray drying is common for drying meat pieces. Vacuum drying, especially freeze drying, is currently important for meats and seafoods. One manufacturer makes meat strips or "bits" by mixing ground meat with isolated soy protein, then extruding and heating-drying the soy and meat product which coagulates simultaneously. Vegetable protein, spun into fiber state or in the form of flakes, is likely to find future favor in formulation of dry mixes.

Dry mixes other than soups are usually casserole dishes that rely on a base of carbohydrate material, principally pasta, potatoes, or rice. Pilaf (bulgur), corn, beans, barley, and special nutritive combinations are possible variations. Salts and hydrolysates are other major ingredients. Added fat, gum or starch thickeners and natural spices or extractives are further ingredients. Garnishes such as dried cheese, crumbs, and certain vegetables are sometimes packaged separately. The spices and hydrolysates often promote longer shelf life in combination with the measures for balancing low-moisture levels of all the ingredients. In addition, providing an inert nitrogen atmosphere in the package is important for dehydrated meats and some vegetables.

Dry soup mixes and dehydrated meals have military importance because of lowered weight and lack of need for refrigeration.

Dry mixes which reconstitute for "dips" are current variations. These are often flavored with dried cheese. Tomato sauce and other sauce mixes are sold alone or sometimes with grains such as rice.

The key to successful, long-term consumer acceptance of dry mixes has been the very great care in selecting or manufacturing ingredients with exceptional stability. Also important is advanced packaging technology to provide special protection against moisture and oxidation. One major company (#565FIS) stated it has regular inspection of its private coding system which requires that all goods be taken back 18 months following manufacture. Several large volume items of that company have a termination time of 15 months, some 12 months, and some even as short as 9 months. The products are amply safe, nutritious, and of satisfactory quality when kept by the consumer at home for periods exceeding warehouse or retail shelf limits.

Cases and overwraps should be open-dated, in English, to promote better stock rotation. The date of shelf display is another recommended practice. Expiry or durability dating is not recommended because any termination of shelf life is dependent on storage conditions. Abuse of products owing

to exposure to high temperatures for extended periods could terminate acceptability long before any stated safety time dating.

X. REFERENCES

- (1) Chain Store Age, 1969 Supermarket Sales Manual, Lebhar-Friedman, Inc., New York, N.Y., July 1969.
- (2) U.S. Department of Agriculture, Agricultural Marketing Research Report No. 509, 1961.
- (3) Copley, M. J., and Van Arsdel, W. B., Food Dehydration, Vol. II, The Avi Publishing Co., Inc., Westport, Conn.
- (4) Galvin, S. L., Packaged Food Composition, U.S. Patent 2,468,744, May 1949.

XI. REPORT REVIEW AND COMMENTS

#505FIS stated with reference to breakfast foods (A):

"We wish to emphasize that our products move very rapidly from manufacturer to consumer and that under present methods we believe our products customarily are purchased on a first-in, first-out basis. If such food products were to bear readable code-dates denoting either the date of manufacture or the date beyond which the product could not be consumed or sold, we fear the natural tendency of consumers would be to purchase most recently manufactured products. Thus, products would be purchased on a last-in, first-out basis, and greater quantities of our product would unnecessarily fail to meet our own standards. This very real possibility would be undesirable and not in the best interest of consumers. We believe that our present coding and surveillance methods insure that our products meet our high standards upon reaching the consumer."

#355FIS stated with reference to breakfast foods (A):

"We agree fully with the concept of case markings to facilitate proper stock rotation and follow this concept for our products. Many shipping containers are pre-printed at the vendors plant prior to receipt at the food processing establishment. To require, as you suggest, labeling of a specific date would involve increased supplier costs and cost increases due to excessive inventory controls. These costs would eventually have to be borne by the consumer.

"We believe that built in product quality is such that rotation on a specific day basis would not provide cost benefits to the consumer. Your stock rotation intent might well be satisfied if the shipping container

code denoted month of manufacture (MOM). This approach recognizes that quality changes are almost impossible to detect over short periods of time and by its more practical nature, would stimulate greater interest and compliance by all segments of the industry.

"From our discussions, I understand the intent of this section [See II. Summary of Recommendations] is to allow industry the option of coding individual packages to meet their individual needs. This situation currently exists throughout the industry and legislative action is not required. Therefore, we would recommend deletion of this recommendation A.

"The issue of open date coding of individual packages has been dealt with quite adequately in the report. We concur with the position that open dating will not assure the consumer of always getting top quality. Time alone is but one factor affecting quality and of minor significance to the choice of raw materials, manufacturing methods, package design and packaging materials, care exercised in quality control, storage and transportation environment, and possible abuse due to excessive or fluctuating temperatures.

"Quality changes are often so slight and subtle that they are virtually undetected over short periods of time such as the duration of time from purchase to consumer use. Specific dates infer significant quality change taking place at a specific time. Such an assumption would lead to consumer rejection of slightly older packages with good quality merchandise left to be eventually destroyed. The selection process would also lead to increased handling damage of individual packages.

"Many food packages are small and irregular in shape with labels currently crowded with mandatory and instructional information. Meaningful code dating would require special coding areas frequently requiring larger labels.

"Your statement that-- "as health hazard problems are low, there is no need to openly date individual packages with date of manufacturing or date of expiry," is quite correct. We believe the same holds true for Date of Shelf Display (DSD). Consumer protection benefits would not justify the added accumulated expenses for implementation. These increased costs would undoubtedly result in higher costs for the consumer.

"We fully agree that the consumer should be given adequate instructions on how to use and store products for maximum total quality and this philosophy is followed throughout our corporation. Our concern appears to center on the best approach for conveying such information to the consumer whether it be positive or perhaps negative, as you have recommended. [See: Do not store in hot humid areas vs. Store in a cool dry place.]

"Within our corporation an extensive staff of home economists and food scientists maintain continual rapport with consumers and instructions are in terms which experience shows have had the greatest impact on the

consumer. The positive approach promotes good practices and avoids listing of all possible undesirable storage or handling situations.

"Differences in education and language comprehension make it almost impossible to establish uniform instructions for all situations. It would appear that some of the detailed information you desire conveyed to the consumer is of a general nature which might be better conveyed in newspaper articles and in public school home economics programs. Keeping food covered during storage or containers and utensils clean is information that can be best conveyed through such general informational programs.

"Would not a general recommendation be more appropriate? Perhaps requiring that where products require special storage or handling to maintain maximum quality such conditions be noted on the package label. We believe this would fulfill your intent."

GARNISHES AND CONDIMENTS

The department of condiment garnishes consists of four product groups: (A) Pickles, olives, and vinegar; (B) Dressings; (C) Sauces; and (D) Spices, extracts, and seasonings.

These product groups will be dealt with separately in accordance with the report format except that part (A), sections II, III, VII B 1-4, contains data for (B), (C), and (D), and section X--REFERENCES for all the product groups--will follow product group (D).

(A) Pickles, Olives, and Vinegar

I. INTRODUCTORY REMARKS

This product group consists primarily of foods prepared by the process of fermentation with or without additional pickling.

II. SUMMARY OF RECOMMENDATIONS (see also section IX of product groups (A), (B), (C), and (D)).

A. Adoption by the New Jersey Department of Health of the coding recommendations of the FDA Good Manufacturing Practices, Federal Register, April 26, 1969, for processed foods. Disclosure of code meanings by food manufacturers to the New Jersey Department of Health on request by the latter.

B. Adoption of the open date of manufacture labeling for all outer cases/overwraps, etc., to assist in stock rotation.

C. Voluntary coding of all individual containers in such cases/overwraps by the food industry with codes of its own choosing (similar in intent to A. above). Such codes should indicate plant location, date of manufacture of final product in container, shift, production line, and any other aspects of products, at the manufacturer's discretion.

D. Stamping of date of shelf display by retail stores for stock rotation and as a consumer aid in home storage stock rotation.

E. Expansion of instructions for consumers' use and storage, as follows:

Pickles, relishes, etc.--Label should state, "Keep all opened products in refrigerator."

Mayonnaise and sauces--Label should state, "Keep all opened products in refrigerator. Clean top of container and cap liners after use before storing."

Spices--Label should state, "Do not store in a hot humid place or expose to direct sunlight. Replace caps tightly after use."

Garnishes, by product group, category, and variety

[illegible]

Source: Chain-Store Age, 1969 Supermarket Sales Manual (1), Lebhar-Friedman, Inc., New York, N.Y., July 1969. Used with permission of publisher.

Product group	Percent- age of total sales	Product category	Percent- age of category sales	Percent- age of total sales	Product variety	Percent- age of depart- ment sales	Percent- age of total sales
Dressings (B)	.68						
		Mayon- naise	33.8	.230			
		Salad dressing	24.5	.167			
		Dressings	32.9	.224			
					Italian	10.5	.071
					French	6.8	.046
					Cheese	2.5	.017
					Russian	2.3	.016
					Thousand Island	2.2	.015
					Cole slaw	1.0	.007
					All other dressings	7.6	.052
						<u>32.9</u>	<u>.224</u>
		Spreads	6.2	.042			
					Sandwich spread	3.5	.024
					Tartar sauce	1.2	.008
					Garlic spread	.8	.005
					All other spreads	.7	.005
						<u>6.2</u>	<u>.042</u>
		Dry dressing mixes	2.6	.018			
			<u>100.0</u>	<u>.681</u>			
Sauces (C)	.66	Catsup	34.6	.228			
					Plain	33.5	.221
					Hot, other flavored	1.1	.007
						<u>34.6</u>	<u>.228</u>
		Spaghetti sauce	19.2	.127			
					Meatless	10.9	.072
					With meat	8.3	.055
						<u>19.2</u>	<u>.127</u>
		Dry mixes	13.7	.090			
					Gravy mix	7.0	.046
					Spaghetti sauce mix/seasoning	2.2	.015

Product group	Percent- age of total sales	Product category	Percent- age of category sales	Percent- age of total sales	Product variety	Percent- age of depart- ment sales	Percent- age of total sales
					Sloppy Joe mix/ seasoning	1.4	.009
					Chili mix/ seasoning	1.1	.007
					Other dry sauce mixes	<u>2.0</u>	<u>.013</u>
						13.7	.090
		Meat sauce	11.4	.075			
		Mustard	8.0	.053			
		Pizza sauce	2.6	.017			
		Chili sauce	2.6	.017			
		Gravies, prepared	1.8	.012			
		Mexican sauces	1.8	.012			
		Hot sauce	1.2	.008			
		Gravy flavor- ing (liquid)	.7	.005			
		Cocktail & seafood sauce	.6	.004			
		All other sauces	<u>1.8</u>	<u>.012</u>			
			100.0	.660			
Spices, extracts, seasonings (D)	.41	Table salt	12.4	.051	Regular sizes	11.2	.046
					Picnic shakers	<u>1.2</u>	<u>.005</u>
						12.4	.051
		Pepper	16.9	.070	Black	15.7	.065
					Red/Cayenne	1.0	.004
					White	<u>.2</u>	<u>.001</u>
						16.9	.070
		Whole & ground spices	13.3	.054	Cinnamon (plain, all forms)	3.9	.016
					Paprika	2.0	.008
					Nutmeg	2.0	.008

Product group	Percent- age of total sales	Product category	Percent- age of category sales	Percent- age of total sales	Product variety	Percent- age of depart- ment sales	Percent- age of total sales
					Cloves	1.0	.004
					All other	4.4	.018
						<u>13.3</u>	<u>.054</u>
		Leaf spices & herbs	3.8	.016			
					Oregano	1.4	.006
					Basil	.5	.002
					Thyme	.4	.002
					All other	1.5	.006
						<u>3.8</u>	<u>.016</u>
		Extracts, food coloring	11.8	.048			
					Vanilla extract	7.7	.032
					Lemon extract	.8	.003
					All other extracts	2.0	.008
					Food coloring	1.3	.005
						<u>11.8</u>	<u>.048</u>
		Vegetable seasoning	10.1	.041			
					Onion items	5.5	.022
					Parsley flakes	2.2	.009
					Celery items	1.3	.005
					Chopped chives	.7	.003
					Bell pepper flakes	.4	.002
						<u>10.1</u>	<u>.041</u>
		Other seasonings/ flavorings	31.7	.130			
					Monosodium glutamate	7.5	.032
					Garlic salt	4.8	.020
					Meat tenderizers	4.5	.018
					Garlic powder, juice, cloves, etc.	4.0	.016
					Seasoned salt/ general purpose	3.7	.015

Product group	Percent- age of total sales	Product category	Percent- age of category sales	Percent- age of total sales	Product variety	Percent- age of depart- ment sales	Percent- age of total sales
					Seasoned salt/ seasoning mixes, special purpose	3.6	.015
					Chili powder	1.8	.007
					Horseradish (shelf-stable)	.6	.002
					Cinnamon w/sugar	.4	.002
					Charcoal flavoring	.3	.001
					All other seasonings/ flavorings	.5	.002
						31.7	.130
				100.0			.410

IV. TYPE OF PROCESSING AND PRESERVATION

Pickles.--All pickles are made from cucumbers of specified sizes by lactic acid fermentation in a salt brine, whether they are of the sour, sweet, or dill varieties. Lactic acid is produced during fermentation to produce the characteristic sour taste associated with these products. The concentration of brine is controlled throughout the fermentation and holding process because the salt of the brine suppresses the growth of virtually all but that of the desirable lactic acid-producing bacteria. There are numerous modifications and amplifications of this process.

After fermentation, sour pickles are washed and packed in dilute vinegar. Sweet pickles are similarly prepared by the use of sweetened vinegar which is added to the salt solution. Processed dill pickles follow a similar procedure, but include the addition of dill and spices to the brine before and after processing. These types of pickles are usually made from salt stock; that is, cucumbers which have been stored in a salt brine for days or weeks, then removed from the original brine solution and placed in a solution containing vinegar, sugar, spices, or herbs. Some dill pickles, made without the salt stock process, are processed directly with brine, vinegar, spices, and herbs and then packaged, sealed, and pasteurized. With the exception of the bulk pickles, these products are usually packed in sealed, screw-capped glass jars (2, 3).

Olives.--Olives, both green, which are not fully ripe, and dark, or fully ripe, contain a bitter tasting material which is largely removed by storing the olives in dilute solution of lye until sufficient reaction has occurred at which point the lye is washed out and the olives are cured in brine. In green olives, sufficient acid is produced during fermentation so that the olives reach a pH of 3.8 or less (2).

Green olives are usually not pasteurized. However, they may be pasteurized at 140°F. or filled with hot brine at 175-180°F. to prevent formation of sediment resulting from microbial growth (3).

After fermentation, some olives are pitted and stuffed with pimientos, after which they may again be fermented.

Ripe olives require lye treatment to intensify the color as well as to reduce their bitter flavor. Preliminary brine treatment is also necessary to firm the fruit in addition to curing. Since the pH of the finished olives is near 7.0, they must be heat-sterilized in hermetically sealed containers.

Olives are packed in cans or glass. Cans are somewhat easier to process because they are less fragile.

Vinegar.--When the unqualified word "vinegar" is used, it means--according to FDA regulations of the Department of Health, Education, and Welfare--cider vinegar made from apples, and must contain at least 4 grams of acetic acid per 100 cubic centimeters of vinegar. Originally, this was the only type of vinegar sold in this country. Now other types are produced, such as white or distilled vinegar, wine vinegar (from grapes), vinegars from other fruits, as well as some to which various herbs, such as tarragon, have been added. Regardless of their basic origin, all vinegars are used for the acid they contain, which is predominantly acetic acid.

Because of the relative importance of cider vinegar, only its manufacturing process will be discussed. After cider has been pressed from apples, the sugars are permitted to be fermented to alcohol. While there are natural yeasts present in the cider, special starter cultures are used for the acetic acid fermentation of the alcohol to control the uniformity of the vinegar and assure efficiencies of fermentation (2).

Various methods are used for incorporating the necessary oxygen into the material at this stage. Both fermentations are temperature-sensitive and require careful temperature control to produce products of desirable and reproducible quality. Vinegar may be filtered after production for clarification, then pasteurized by heating to 150°F., after which it is poured directly into bottles.

V. QUALITY CHARACTERISTICS

Pickles are used for their particular taste qualities as condiments and adjuncts to more basic portions of meals. They also serve to garnish foods. They are not normally used to contribute to a nutritionally balanced meal. Characteristic green color and sufficient crispness are requisites.

The pickle industry experienced some difficulties in the past with development of off odors, flavors, and product softening. These problems have been prevented through such simple means as more adequate pasteurization. Controlled time of shelf life does not provide the means of preventing poor products from reaching the consumer. This is more effectively done through quality assurance programs of an industry eager to sell its products.

Olives depend largely on their color, uniform size, and unblemished surfaces for acceptable appearance. Although they do furnish some nutritional value, they too are used principally as adjuncts.

Vinegars are used solely for their acidity as a condiment when used in salads, cooking, and other food preparations. Clarity is a common requirement. Minimum acidity levels are controlled by FDA regulations. Flavors other than that of acetic acid in vinegars such as cider and wine types are important to the consumer, particularly in cooking.

There are generally no public health hazards associated with these products because they are protected from spoilage by their relatively high acidity or by adequate heat treatment.

VI. PROCESSING AND STORAGE QUALITY LOSS FACTORS

Pickles.--Although cucumber pickles and products made from them are used mainly as condiments, they do have some nutritive value. However, during the salting process, they have been found to lose 86 percent of their thiamine, but suffer no loss of calcium or iron (4).

Olives.--None of their oil is lost when moisture and sugar removal are taken into account. Brining changes the natural sugars into lactic acid (3).

Vinegar.--Nutritional losses are not significant in vinegar because it is used solely as a condiment.

VII. PRESENT PRACTICES OF CODE DATING/PUBLIC DATING

A. Voluntary Food Industry Code Dating and Monitoring

Company #470FIS codes individual packages with date of packing and uses schedules for determining time of removal from shelves.

Company #480FIS codes individual packages and has established storage time limits.

Company #530FIS codes packages with production date for stock rotation only for items known to have long shelf life, which includes products in this group.

Company #30FIS codes these products.

Company #720FIS codes all cans. It is preparing to code all glass lids to comply with FDA Good Manufacturing Practices.

Company #800FIS states, "...in regard to legal requirements with respect to date labeling in States and municipalities - I don't know exactly what you are referring to in this question, except perhaps the coding of the label.

This is done usually only on Cider Vinegar. There are to my knowledge, no actual legal requirements that we do so. It is done only for our own purposes.'

B. Legal or Required Dating

The following discussion applies to product groups (A), (B), (C), and (D).

1. Federal.--There are no Federal requirements for public dating. The FDA regulations contained in the Federal Register, April 26, 1969, Good Manufacturing Practices, indicate that FDA would like code dating for interstate and intrastate commerce shipments.

2. State.--No dating requirements as such exist, particularly for any of these products, except those required for canned products (see canned foods, section VII B 2).

3. Municipal.--No requirements were noted.

4. Foreign.--No requirements were noted, except for canned foods.

VIII. FOOD PRODUCT ITEM LIST

A. Shelf Life--Food Industry Sources (FIS)

<u>Food item</u>	<u>Time*</u>	<u>FIS No.</u>
Cider vinegar	6M	30
Cider vinegar	24M	480
Dill pickles	12M	630
Distilled vinegar	6-12M	800
Olives	12M	30
Relishes (tins)	2Y	720
Relishes	6M	30
Relishes (glass)	3Y	720
Relishes	15-18M	630
Sweet pickles	15M	630
White vinegar	6-12M	800
White vinegar	6M	480
White vinegar	9M	30
Wine vinegar	6M	30

*Y=year, M=month.

Company #800FIS provided the following information:

"...we are manufacturers primarily of Apple Cider and White Distilled Vinegars. The shelf life of these products, if they are properly sterilized and if the material is kept in a cool place, should be from six months to at least a year.

"In regards to storage of materials, there should be no change in color, flavor, texture, etc. of White Distilled Vinegar. However, in storage, Cider Vinegar may change in regard to color; that is, it may turn slightly darker. There should be no change in nutritive value, and there should be no chemical or microbial deterioration."

IX. RECOMMENDATIONS ON BEST MEANS OF FOOD QUALITY MAINTENANCE

The durability of these products depends in part on their composition and processing methods. In these products, as in others, deterioration is accelerated by higher storage temperatures. Since they are stored at ambient temperatures without control, shelf life cannot be determined by mandatory expiry dating.

The survey team recommends the use of:

- A. Open date of manufacture, in English, on shipping cases to encourage stock rotation.
- B. Code dating of all individual packages.
- C. Stamping date of shelf display on all packages.

Home storage of these products should contain the following instruction:

"After opening, keep container tightly closed in refrigerator."

X. REFERENCES

See section X in (D) below.

(B) Dressings

I. INTRODUCTORY REMARKS

According to Chain Store Age, dressings constitute 0.68 percent of supermarket sales (see (A) above for further breakdown). Included in this group are mayonnaise, salad dressings such as French, Russian, Roquefort, Italian, Thousand Island, and numerous formulations with special predominant flavors and textures (e.g., onion, Caesar, garlic, wine).

II. SUMMARY OF RECOMMENDATIONS (see section IX below and section II (A) above).

III. TYPE OF FOOD AND PRODUCT GROUPS, IV. TYPE OF PROCESSING AND PRESERVATION, and V. QUALITY CHARACTERISTICS

Two items basic to dressings are (vegetable) oil and vinegar as individual (separated) phases or as a homogeneous emulsion. Two-phase dressings require

shaking for temporary suspension at time of table serving and use. There may be suspended or settled spices, cheese pieces, or vegetable pieces in such dressings (e.g., Italian and Caesar). Homogeneous (or homogenized) dressings are emulsified types of which mayonnaise is the most predominant. This is a semisolid emulsion that relies on natural emulsifying properties of egg yolks. Other "spoonable" salad dressings having mayonnaise-like semisolid consistency rely on thickening agents, usually cooked starch and possibly vegetable gums. These are sometimes called "boiled" dressings. Mayonnaise contains 65 percent or more vegetable oil. Dressings with lower oil content may be pourable though emulsified, such as some French dressings (not less than 35 percent vegetable oil), or they may be semistable or separate oil-aqueous phases which require shaking at time of use.

Mayonnaise and salad dressings have FDA standards of identity stating minimum oil contents (30 percent for salad dressing), the emulsifying or thickening ingredients, condiments and flavors (salt, sugar, monosodium glutamate, spices, etc.), acid sources, citrus juices, and certain additives and sequestrants. Tomato, added as paste, puree, or catsup typifies the American version of French dressing.

Whereas formerly most dressings were homemade, today in the United States factory-made products provide the convenience, varieties, expertise, and uniformity of taste from formulations that have rapidly become accepted by consumers. Some manufacturers supply only the blends of the solids (flavors, spices, thickening, and emulsifying agents, etc.) to which the consumer adds vinegar and vegetable oils in measured amounts in specially calibrated and marked cruet bottles; the combined ingredients are then shaken in the closed bottles. Low-calorie dressings rely on partial or total omission of vegetable oil but have gums or thickeners that provide mouth feel, body, and salad clinging properties that simulate the physical and organoleptic properties of vegetable oils.

Whether served on vegetable or fruit salads, as spreads in sandwiches, with meats or fish, or even as dressing on bland foods such as rice, dressings have boomed in popularity to vie with margarine and butter and with traditional condiments such as mustard and catsup. Their success seems to relate to affluence, widened taste sophistication, and a demand for convenience. This field of products, by reason of competitiveness and new customer recruitment, is high on the list in application of advanced quality control methodology (#565FIS). Exceptional care appears prevalent among the leaders in formulation, selection of high-quality ingredients, factory manufacturing standards, and in self-policing of shelf life. The shelf-life properties relate to sanitation of ingredients and equipment (controlled low-microbiological population of raw product ingredients and absence of harmful microorganisms throughout all phases of production), stability of emulsion, absence of rancidity in oils, freshness of flavor, and nonfading of color.

VI. PROCESSING AND STORAGE QUALITY LOSS FACTORS, subsections A - D, and VII. PRESENT PRACTICES OF CODE DATING/PUBLIC DATING, subsection A

Age of these products can cause loss of flavor and color qualities which, combined with sharp temperature changes, can cause phase separation of emulsions. To assure good shelf life, the vegetable oils are properly winterized and deodorized, protected with inert gases during shipping and handling, and are further protected against oxidative effects of trace metals by EDTA. The finished product is commonly stored in cool warehouses (minimum temperature 40°F.). In the case of mayonnaise, production, warehouse, and transport time to the retail outlet is typically 4 to 7 weeks. Stocking of retail shelves is preferably not in direct lighting. While turnover in the retail store may have a median time of 5 weeks, product dates showing 5 months after date of manufacture are regarded as an "alert" stage for company concern. Six months under proper storage conditions is acceptable, but sometimes quality control surveillance dictates pickup by the manufacturer for reasons of organoleptic deterioration. In such cases, out-of-date products are withdrawn from sale.

Company #120FIS gave the following information on mayonnaise:

"Identification of Potential Causes

- (a) The use of old or inferior ingredients in processing can cause loss of quality even before the end-item is made and accelerate loss of quality as the product ages. Our company has strict quality specifications for all ingredients used, including age of ingredients, and these are strictly observed.
- (b) The age of the product can cause loss in quality. We observe maximum storage times of 3-4 weeks in plants and 1-3 weeks in distribution warehouses. The holding temperature of the product can cause loss in quality. We stipulate the most desirable storage temperature range to be 45-75°F. We also stipulate the minimum storage should be 40°F. to prevent freezing and possible emulsion break.
- (c) The inadequacy of the package to protect the product could be a cause in loss of quality. At present, we use only glass in packaging this product and make sure the closure makes a good tight seal. All packaging material (especially closures including cap liners) are tested extensively prior to approval for use.

"Food Industry Practices for Quality Maintenance

- (a) Each of our plants refines and deodorizes the oil blends just prior to use in that same plant; i.e., no inventory oils are used. The shelf life of the product begins from the moment of deodorization.

- (b) We do extensive quality control tests (subjective, objective, and microbiological) on all ingredients as received in our plants and prior to use, at various stages of processing, and on the finished products. In all cases, results of tests must conform to our high standards of reproducibility, organoleptic acceptability, functional value, stability, and nutritional value.
- (c) During warehousing, regular stock rotation (first in, first out) is observed and product is stored in well ventilated areas, preferably at 45-75°F., and should not be stored at temperatures below 40°F.
- (d) We...retain samples of each day's product at room temperature (75°F.) and 95°F. These samples are organoleptically tested at regular intervals and checked for microbiological growth.
- (e) We make product to keep pace with specific orders.

"Mayonnaise: Our mayonnaise is periodically checked subjectively and objectively during processing (and during storage for those factors marked with an *) for the following quality characteristics:

- (a) Flavor* and color.
- (b) Dispersion of oil and water phase droplets.
- (c) Freedom from extraneous material.
- (d) Body characteristics*
- (e) Salt, acid (as Acetic), egg and oil content.
- (f) Bump score (resistance to break-down on shipping).
- (g) Microbiological Population (total bacteria, yeast and mold, aciduric bacteria and freedom from salmonella)*.
- (h) Freeze Test* (resistance to emulsion break during cold weather and refrigeration) and resistance to moisture separation*.
- (i) Nutritional value, including fatty acid composition.
- (j) Net content in meeting label declaration.

"Distribution Cycle

All mayonnaise products are transported from plant to warehouse via trucks or railroad cars which must be in a clean and sanitary condition. Trucks in clean and sanitary condition are used to transport products to stores. Trucks and railroad cars are to be unloaded within a reasonable length of time after reaching destination and not be allowed to stand for

extended periods of time on hot summer days or cold winter days. We prefer shipping via trucks to minimize possibilities described in previous sentence.

"Retail Storage and Display

During retailing, product should be stored at ambient temperature on store shelves and not in direct sunlight. Preferably, the store should be airconditioned.

"Consumer Factors

- (a) Consumer should store product at ambient temperature until opened and then refrigerate. We have statement "Refrigerate After Opening - Do Not Freeze" on closure of this product.
- (b) The consumer does not always observe sanitary conditions while using the product, such as using the same knife for spreading margarine on bread as previously used for some other product such as cheese. This can cause off-flavors. Care should be exercised not to chip the mouth of the glass jar and thereby introduce glass fragments.
- (c) At times the consumer may store this product for extended periods in a refrigerator which is too cold or in an area too near the freezer compartment causing the product to freeze and show free oil on the surface after thawing out.
- (d) We have observed at times consumers purchasing an excessive amount of product during a sale period and then holding the product too long before using, sometimes storing the excess in the deep freeze.

"Voluntary Coding

Our mayonnaise product is marked in the same manner with the same code designation as the margarine products. This code is put on the label of the individual package and the shipping case."

Pourable emulsified salad dressings and those containing ingredients of a highly perishable nature such as cheese are subject to care against overage and extremes of storage temperature. Typical durabilities are 8-9 months before withdrawal by the manufacturers' representatives, but "alert" times for quality control examination may be as early as 3 months after date of manufacture. The more stable formulations, often of the two-phase or low-calorie types, are routinely withdrawn from channels of trade after 10 or 12 months. Chain stores that manufacture their own brands have comparable standards for "guaranteed store shelf life" after which they require withdrawal from sale. Even refrigerated dressings have schedules that are modest in age time and require checking at "alert" dates.

One nationally known manufacturer code dates all labels with an "alert date"; beyond that date the product is still usable by the consumer within a reasonable time, provided the product has not been subjected to adverse conditions of temperature or exposure to sunlight.

One leading supermarket operator (#530FIS) dates these products with a coded expiry date, at which time the outdated products are removed from sale.

VII. PRESENT PRACTICES OF CODE DATING/PUBLIC DATING, subsection B, Legal or Required Dating, is covered in product group (A) above.

VII. C. How Dating Influences Quality Maintenance: Advantages and Disadvantages of Dating

Dating offers no practical means of consumer protection from product mishandling or poor processing practices.

VIII. FOOD PRODUCT ITEM LIST

A. Shelf Life--Food Industry Sources (FIS)

<u>Food Item</u>	<u>Time*</u>	<u>FIS NO.</u>
Blue cheese dressing	150D	520
Coleslaw dressing	150D	520
French dressing	10M	565
Italian dressing	12M	565
Catsup	5M	30
Catsup	18M	480
Catsup (tin)	2Y	720
Catsup (glass)	4Y	720
Mayonnaise	3 1/2M	30
Mayonnaise	6M	120
Mayonnaise	3M	480
Onion dressing	12M	565
Russian dressing	12M	565
Salad dressings	3 1/2M	30
Sandwich spread	3M	30

*Y=Year, M=Month, D=Day.

Despite the care given to mayonnaise and salad dressings prior to their sale, these products are subject to much neglect in homes. Education on the necessity of storing these products in refrigerators (but not freezers) after opening may help to ensure against flavor fading and rancidity. Even here, overly long storage promotes thickening and sometimes unwanted winterizing of oils, which can be reversed by heating containers in warm water.

IX. RECOMMENDATIONS ON BEST MEANS OF FOOD QUALITY MAINTENANCE

Open coding, in English, on cases would serve the interests of the manufacturers by assuring proper stock rotation in channels of distribution and at retail stocking levels. Since timing in warehousing and transportation

of these products is more critical than for most other foods, general acceptance by the industry should result, to the benefit of both producers and consumers. Dating of shelf display would allow the consumer to rotate the product in her home as well as aid in stock rotation at retail levels.

X. REFERENCES

References for this section follow product group (D) below.

(C) Sauces

I. INTRODUCTORY REMARKS

All these products, though differing considerably in composition, are used as adjuncts to more basic foods. They are primarily used for their savory characteristics rather than for their nutritional value. Generally, they are seasoned with spices and herbs, and add to the appearance of basic preparations.

II. SUMMARY OF RECOMMENDATIONS (See section IX below and section II of product group (A) above)

III. TYPE OF FOOD AND PRODUCT GROUP (See section III of product group (A) above)

IV. TYPE OF PROCESSING AND PRESERVATION

The largest percentage of category sales is catsup, the composition of which is established by Standards of Identity issued under the Federal Food, Drug, and Cosmetic Act.

Catsup is processed by using only the strained pulp of tomatoes, to which are added salt, vinegar, spices, flavorings, and natural sweetening agents. Cooking is primarily responsible for getting the proper consistency. Control must be exercised not to overheat the product and darken the color.

Catsup is customarily bottled hot and capped. The best closing temperature is 190°F. Heat processing after closing depends on the ability of the equipment used to keep product at 190°F. at closing time. Storage is at ambient temperature.

Spaghetti sauces are normally cooked, filled into cans, sealed, and sterilized. Storage is at ambient temperatures.

Dry mixes are mixtures of dehydrated ingredients discussed elsewhere under dry fruits and vegetables. Packaging is in pouches of laminated materials which are good vapor barriers and may consist of a polymer film, aluminum foil, and paper.

Chili sauce, characterized mainly by skinless but unstrained tomato solids, is made according to the same general procedures used for catsup. 1/

Prepared mustard, a very commonly used sauce, is usually made by mixing ground mustard seed or mustard flowers with salt, vinegar, sugars, and other condiments.

V. QUALITY CHARACTERISTICS

Catsup is required to have an acceptable red color, viscous consistency with no tendency to separate, and suitable combinations of acid, spice, and mildly sweet flavor to meet accepted needs of particular types.

All sauces are required to have adequate viscosity for their intended purpose. Color and balance of flavor usually associated with the respective products are the bases of judgments by the consumer. This also applies to the sauces and gravies since they are prepared from dry mixes.

Many of these products, although they are generally not standardized, have sufficiently high-acid content (low pH) to prevent growth of pathogenic bacteria

VI. PROCESSING AND STORAGE QUALITY LOSS FACTORS

A. Identification of Potential Causes of Quality Losses

Excessive mold counts may occur in catsup because of inadequate grade inspection of raw tomatoes, improper trimming, and inadequate sanitation during processing which was not detected by quality control methods on line processing or occurred by accidental introduction.

Dark discoloration of the top layer of bottled catsup is the result of aeration in filling, too much headspace, or faulty cap design.

Lack of suitable red color in catsup may be caused by using tomatoes which do not meet minimum color standards adopted by companies for production of uniformly adequate color. It also may be the result of overheating in processing.

Dry mixes have the possibility of containing salmonella bacteria which might enter via raw materials or unsanitary handling practices.

B. Food Industry Practices for Quality Maintenance

Producers of catsup and similar products analyze raw materials, the product during processing, and the product after packaging by physical, chemical,

1/ For a description of the manufacturing and quality control practices of chili sauce and catsup, see Bulletin No. 27-1 revised, of the National Cannery Association (5).

and bacteriological means. This may not be a universal practice or may not be practiced in complete detail by all processors, but it is known to be used by major manufacturers.

C. Channels of Distribution

The known defects attributable to distribution, warehousing, or retailing practices are those of exposure to excessive temperatures which cause product deterioration.

D. Consumer Factors

After opening, bottles of catsup, chili sauce, and other tomato products may blacken on the neck and cap during consumer storage if they have not been wiped clean and especially if they have not been refrigerated. Opened packages of dried mixes may develop off-odors and flavors, primarily due to the rancidification of fats.

VII. PRESENT PRACTICES OF CODE DATING/PUBLIC DATING

A. Voluntary Food Industry Code Dating and Monitoring

Company #30FIS codes all products.

The following exchange took place between a member of the survey team and company #720FIS:

"Q. How does your company code its products?

"A. (1) Company, on tin, embosses tin can and codes case.

(2) On glass, the code is not present on the individual container but is on all cases. We are experimenting with glass cap coders on catsup this year and hope to use them in 1970 to comply with G.M.P.

"Q. How are these products monitored as to shelf life? If you have a system of recalling out-dated goods, how does it work?

"A. We plan to sell all products in 1 1/2 years under our label and we have at least 2 years shelf-life."

Company #480FIS codes all products.

Company #470FIS codes all products and sets its own expiry schedule.

B. Legal or Required Dating

Subsections 1-4 are discussed in product group (A) above.

C. How Dating Influences Quality Maintenance: Advantages and Disadvantages of Dating

See product group (A) above.

VIII. FOOD PRODUCT ITEM LIST

A. Shelf Life--Food Industry Sources (FIS)

<u>Food Item</u>	<u>Time*</u>	<u>FIS No.</u>
Barbecue sauce	16M	30
Catsup, glass (room temp.)	4Y	720
Catsup, tin	2Y	720
Chili sauce	18-24M	480
Chili sauce	16M	30
Cocktail sauce	18M	480
Cocktail sauce	12M	630
Peppers, tin (room temp.)	2Y	720
Pizza sauce	36M	480
Relishes, glass (room temp.)	3Y	720
Relishes, tin	1 1/2Y	720
Spaghetti sauce, meatless	12M	480
Spaghetti sauce, meat flavored	6M	480
Spaghetti sauce, with mushrooms	6M	480
Spaghetti sauce, with meat-like bits	6M	480
Steak sauce	24M	630
Tartar sauce	3 1/2M	30
Tomato paste	36M	480
Tomato sauce	30M	480
Worcestershire sauce	36M	630

*Y=year, M=month.

Company #720FIS stated in reply to our questions:

"Q. How were these shelf-life periods arrived at, and what change or changes in product quality determine end of shelf life?

"A. Actual storage of samples for 3 years; however, in new products we store them 6 months @ 100°F. = 1 year and 3 months @ 120°F. = 1 year and then shoot for one year minimum shelf life. It is either flavor or color which go bad. In tin it's usually flavor and in glass it's color.

"Q. Is there any difference in product stability between identical products packed in glass and those packed in cans? We assume that glass is usually chosen for packing higher quality items.

"A. Yes--as you can see (see tabulation above), glass has much more stability--maybe one year over tin. However, with some of the new enamels, the can is gaining on glass."

IX. RECOMMENDATIONS

Shelf durability cannot be controlled by open expiry dating because shelf life depends, in part, on processing, filling, and quality control practices exercised by the processor.

The survey team recommends the use of:

- (1) Open date of manufacture, in English, on shipping cases to encourage stock rotation at all stages.
- (2) Code dating of all packages on voluntary basis.
- (3) Stamping date of shelf display on all packages.
- (4) Home storing of all opened bottles and jars in refrigerator with a note to consumers to clean top of bottle and inside of cap with a clean disposable towel before each restorage period. Hermetically sealed canned products should be used completely at any one serving.

(D) Spices, Extracts, Seasonings

I. INTRODUCTORY REMARKS

All of the products in this group are used primarily for their flavor value, to some extent for their preservative properties, and to a more limited extent for effective coloring. Some of these products do have some nutritional value but, in almost all cases, this is an inconsequential consideration.

II. SUMMARY OF RECOMMENDATIONS

See section II of product group (A) above.

III. TYPE OF FOOD AND PRODUCT GROUPS

See section III of product group (A) above.

IV. TYPE OF PROCESSING AND PRESERVATION

Salt is obtained from one of three major sources: by mining salt in the form of rock salt, by dissolving salt from subterranean deposits, or from sea water by evaporation of the water by means of solar heat. Various material impurities are removed by refining processes so that the salt of retail commerce consists of nearly pure sodium chloride. Small amounts of potassium iodide are customarily added to serve as a preventive for goiter where normal diets are deficient in iodine. The size of salt granulation is standardized to promote convenient use by consumers. Salt is commonly packed in sealed paper containers and stored at room temperature.

Spices, which include seeds, pods, roots, leaves, and bark of numerous plants, are mainly imported into the United States. Processing involves some mechanical methods of cleaning to remove various types of foreign matter. Some major processors fumigate some or all of the shipments of raw materials before use to destroy all stages of insect life. Other processors fumigate certain lots of spices, based on past experience of the possibility of insect infestations. Some producers sterilize those lots of spices which might be potential carriers of bacteria or mold or both. Processors of spices and food processors who use spices as ingredients make bacteriological analyses of incoming deliveries of spices to judge acceptance or rejection of deliveries. The microbiological standards of food processors and spice concerns meet those applicable to foods. Some processors routinely analyze their spices for insect and insect fragment counts, and accept or reject incoming lots on the basis of their results.

Grinding of spices is done in various types of mills best suited for the particular spice. Ground spices are sifted before packaging to remove coarse particles, fibrous material, and any remaining foreign matter. Ground spices are packed in cans and bottles. Many spices are now ground by means of cryogenic milling, which involves cooling with either liquid nitrogen or carbon dioxide to minimize evaporation of the natural flavors and aromas and reduce heat damage to flavor compounds.

Whole spices are either packed directly after cleaning or are further prepared, e.g., the cutting of stick cinnamon to specified lengths, or the cutting of bay leaves to fit convenient package sizes. They are packed in either cans, bottles, or cartons and are stored at room temperature. Blends of ground spices, often with additions of salt, are made by simple mixing and grinding.

No special mention is made of herbs because they are closely related in qualities to spices and are handled in the same operations.

Vegetable seasonings, such as those containing onions, parsley, and chives, are first processed in the manner described in the dried foods discussion. Some seasonings are in the form of oleoresin extracts coated by salt, which are obtained from spices by solvent extraction and subsequent removal. These spice extractives are standardized organoleptically. Of significance is the fact that these products are, on extraction, virtually sterile and contain no form of insect life but may be contaminated if handled improperly.

Meat tenderizers contain various enzymes, such as papain from papaya, trypsin from animal pancreas, and bromelin from pineapple. These may be standardized with edible diluents to provide easy uniform use by the consumer.

In the past, monosodium glutamate has been made from wheat gluten and corn gluten by several chemical processing steps which involve acid treatment to make glutamic acid hydrochloride, glutamic acid, and finally monosodium glutamate. Monosodium glutamate is now more commonly made by fermentation of dextrans or glucose as the basic substrates.

Flavoring extracts, of which vanilla and lemon extracts are the biggest sellers, contain at least 35 percent alcohol. Manufacturing processes vary with product as well as with manufacturer. However, vanilla beans are usually cut into small pieces. One method of extraction is to percolate 45 to 50 percent alcohol through the vanilla bean pieces. Sugar and glycerine may be added during the percolation. Concentrated extracts may then be blended according to formula and diluted to final strength. Synthetic vanillin may be added as extender with suitable label declaration.

Lemon extract is made from lemon oil which has been pressed from lemon peel. Here, too, the finished extract contains at least 35 percent alcohol.

Other extracts, whether from natural or synthetic sources, are prepared with alcohol in similar ways. Extracts are usually packaged in amber colored bottles to protect against light-induced flavor changes and are stored at room temperature.

Colors for use in food are solutions of coloring materials which are manufactured to produce products that conform to the most stringent specifications set up by the FDA. Each batch of color manufactured must be certified by the FDA after analysis, showing its compliance with the standards and thus assuring consumers of its safety for use.

V. QUALITY CHARACTERISTICS

Some spices such as cinnamon and cloves owe much of their flavor value to the essential oils they contain. These oils have a characteristic odor and may evaporate and lose their flavor in time. Other spices, such as black and red pepper, owe their taste to pungent "biting" capsicum constituents, even though they too have characteristic volatile fragrances. Characteristic flavors and aromas are more readily discernible from ground than from whole spices.

There may be some bacteria and molds carried by spices but several leading spice processors exercise quality assurance and control programs to assure themselves and their industrial consumers that their spices are microbiologically acceptable.

Meat tenderizers have a softening effect on the protein muscle part of the meat to which they are applied. However, they soften only those portions with which they are in contact.

Monosodium glutamate has a salty and somewhat sweet taste. Its function is to accentuate and enhance other flavors at low (0.1 percent) use levels but not to introduce its own flavor, which in high concentration is reminiscent of chicken broth flavor. There are no microbiological hazards resulting from the use of this seasoning. In searching the scientific literature, no references were found on public health hazards of a microbial or toxic nature in monosodium glutamate.

Obviously, flavoring extracts have sufficient amounts of their characteristic flavors to be able to impart those flavors to the products to which they are added. There are no microbiological hazards related to the use of flavoring extracts.

VI. PROCESSING AND STORAGE QUALITY LOSS FACTORS

Table salt may flow slowly owing to absorption of moisture when exposed to humid conditions, and then lump and cake when followed by subsequent drying in the consumer's house. This may occur at any time during storage or transportation if the containers are of a poor packaging material or are physically damaged in transit, but is most likely to occur in the home after containers have been opened and subsequently stored improperly. During warehouse storage, packages are protected with adequate wrapping materials so that caking at this stage is not likely. Manufacturers also protect against caking by the addition of small amounts of FDA-approved anticaking agents.

Some spices gradually lose their characteristic odor and flavor, especially those of the more aromatic type such as cinnamon and cloves. This tendency is considerably greater after the spices have been ground. Some spices, such as the red peppers, lose their characteristic color when exposed to light.

The development of insect life in stored spices is a possibility because some insect forms are indigenous to spices. The original infestation may occur at any time from the original source of production, which is usually foreign, to the consumer's house storage area. Since it is not practical to store spices in a refrigerator where insect life is arrested, tightly closed containers and storage in clean areas are the best existing means of protecting against such infestation in the home.

Several large producers of spices make quality control inspection efforts, fumigating products when necessary to ensure that relatively insect-free products are merchandised. Dating would not assure the receipt of insect-free spices because the presence of such insects is not related to the age of the product.

Flavoring extracts will normally retain their flavoring qualities for indefinite periods as long as they are stored capped. Failure to cap the bottle during home storage can result in rapid evaporation of the alcohol, accompanied by loss of flavoring components. Extracts may develop a terpene (pine oil) odor if left uncapped, but otherwise are stable products.

VII. PRESENT PRACTICES OF CODE DATING/PUBLIC DATING

A. Voluntary Food Industry Code Dating and Monitoring

Company #30FIS code dates all packages of these products. Company #530FIS codes all of its packages with production dates for stock rotation only. Company #114FIS codes all of its packages with month, day, and year of production.

B. Legal or Required Dating

Subsections 1-4 were discussed in product group (A) above.

C. How Dating Influences Quality Maintenance: Advantages and Disadvantages of Dating

Open dating of spices will not assure the consumer of always getting top-quality products because storage stability and shelf life are dependent on choice of raw materials, age of raw material when processed, package design and packaging materials, care exercised in quality control, and storage and transportation environment. For example, a newly ground and packaged spice may have been ground from an old and abused lot of whole spices, but might bear a more recent date than a spice ground and packed only a short time previously but from whole spices which were of much more recent harvest and handled and stored under the most exacting conditions.

Open dating of flavoring extracts will not benefit the consumer because these products have a long shelf life when properly sealed.

VIII. FOOD PRODUCT ITEM LIST

A. Shelf Life--Food Industry Sources

Company #530FIS codes spices, extracts, and meat tenderizers with a production date for stock rotation in its warehouses and supermarkets. These products are designated as having virtually no quality change over extended periods of time. (Note--Turnover of these products is assumed to be fast enough to keep deteriorated products off the retail shelves.)

Company #114FIS conducted a shelf-life study of its own spices, herbs, and seasonings specifically for this survey. The study was of singular value both to the company and to the survey team, since the spice trade in general had little if any such data on stability available. Since the study was conducted under very restricted time limits to meet the survey's needs, specific decisions of shelf-life termination were not made, but the general results are as follows:

- (1) The evaluation of the spices was by organoleptic evaluation of color, flavor, and texture.
- (2) All data refer to spices packed in glass containers with screw top closures. Shelf life of these spices is as follows:

<u>Product</u>	<u>Shelf life</u>
Whole spices	5 years
Ground spices	2-3 years
Seasoned salt spices	1 year
Dehydrated vegetable flakes	6 months

- (3) Insufficient data were available to show that heat affects the quality of spices, i.e., storage under hot humid conditions near cooking area.
- (4) Insufficient data were available to demonstrate that the type of container--i.e., glass, can, or carton--affects the shelf life of spices.

<u>Food item 1/</u>	<u>Time 2/</u>	<u>FIS No.</u>
Extract, almond	10M	30
Extract, vanilla	10M	30
Bouillon, cubes (T)	2Y	630
Bouillon, cubes (plastic)	1Y	630
Bouillon, granulated	2Y	630
Poultry seasoning	14M	30
Seasonings	2Y	630
Basil, whole (G)	2Y+	114
Bell peppers (G)	< 1Y	114
Black pepper, whole (G)	5Y	114
Black pepper, cracked (T)	5Y	114
Black pepper, coarse (T)	5Y	114
Black pepper, regular (T)	3Y	114
Cayenne pepper (G) <u>3/</u>	15M	30
Cayenne pepper (T) <u>3/</u>	12M	30
Cayenne, red crushed (G)	1-2Y	114
Cayenne, red (G)	5Y	114
Celery flakes (G)	1Y	114
Chili powder (T)	6M-3Y	114
Cinnamon, ground (G)	2Y	114
Cinnamon, ground (T)	3Y	114
Cinnamon, stick (G)	5Y	114
Cinnamon, stick (C)	1Y	114
Cinnamon sugar (G)	6M+	114
Cloves, ground (G)	5Y	114
Cloves, ground (T)	5Y	114
Cloves, whole (G)	5Y	114
Cloves, whole (T)	5Y	114
Cream of tartar	15M	30
Dill (G)	< 1Y	114
Garlic chips (G)	< 5Y	114
Garlic minced (G)	< 2Y	114
Garlic powder (G)	1-2Y	114
Meat tenderizer, seasoned (G)	< 1Y	114
Mustard, dry	9Y	30
Nutmeg, ground (G)	2Y	114
Nutmeg, ground (T)	3Y	114
Nutmeg, whole (G)	5Y	114

1/ G = glass; T = metal container; C = carton, paperboard.

2/ Y = year; M = month.

3/ From estimated date of shipment.

<u>Food item</u>	<u>Time</u>	<u>FIS No.</u>
Onion, green (G)	1-5Y	114
Onion salt (G)	2Y	114
Onion powder (G)	< 1Y	114
Onion minced (G)	1Y	114
Oregano, whole (T)	1Y+	114
Oregano, ground (T)	2Y+	114
Paprika (T)	2Y	114
Parsley flakes (G)	1-2Y	114
Pepper flakes (T)	2Y	114
Pumpkin spices (T)	14M	30
Spices	6-12M	817
Spices, ground (T)	15M	30
Spices, ground (G)	12M	30
Spices, whole (G)	20M	30
Spices, whole (C)	17M	30
Thyme, whole (G)	3Y+	114
Thyme, ground (G)	1Y+	114
White pepper, ground (G)	5Y	114
White pepper, ground (T)	5Y	114

IX. RECOMMENDATIONS ON BEST MEANS OF FOOD QUALITY MAINTENANCE

A. Through Dating/Coding

Open dating of individual packages is not recommended (see section VII, subsection C).

Open dating, in English, of all shipping cases and overwraps is recommended to encourage rotation of stock.

Date of shelf display stamping on all packages is recommended to encourage stock rotation at retail stores as well as on the consumer's premises.

Manufacturers should give consumers guidance on home storage temperature conditions and length of storage.

X. REFERENCES

- (1) Chain Store Age, 1969 Supermarket Sales Manual, Lebhar-Friedman, Inc., New York, N.Y., July 1969.
- (2) Desrosier, N.W., The Technology of Food Preservation, revised and augmented ed., The Avi Publishing Co., Inc., Westport, Conn., 1963, pp. 256-259.

- (3) Fabian, F.W., "Food Preservation by Use of Microorganisms," pp.1888-1935, in The Chemistry and Technology of Food and Food Products, by M.B. Jacobs, John Wiley and Sons, Inc., Interscience Publishers, New York, N.Y. 2nd ed., 1951.
- (4) Fellers, C.R., "Effects of Fermentation on Food Nutrients, Brining of Vegetables," pp. 161-165, in Nutritional Evaluation of Food Processing, by R.S. Harris and J. von Loesecke (eds.), John Wiley and Sons, Inc., New York, N.Y., 1960.
- (5) Bigelow, W.D., Smith, H.R., and Greenleaf, C.A., Tomato Products--Pulp, Paste, Catsup, and Chili Sauce, Bulletin No. 27-1, National Canners Association, revised 1950, pp. 1-50.

XI. REPORT REVIEW AND COMMENTS

Company FIS #120 stated the following in relation to dressings:

"In the first place, I agree completely with the conclusion drawn that a code marking giving the date of manufacture, as practiced by the food industry today, is adequate for all practical purposes. It is not in the consumers' interests to date, by an understandable calendar system, the day of manufacture....

"Secondly, I can endorse your position that shipping cases be dated by some understandable calendar system. As I had pointed out to you, we freely decipher our code to warehouse supervisors and the like to allow them to move stock properly, first-in becomes first-out.

"However, I cannot subscribe to your third recommendation, calling for a date to be stamped on the package of a food product as it is placed on the shelf of the retail grocery store. This serves no useful purpose and can, indeed, be misleading. The consumer will consider this date in relation to others, as an index of relative freshness. You can urge her as much as you like to compare such dates within only a given brand, but you know that the comparisons will go across brand lines. 'Distress' but wholesome merchandise representing products that may have been held too long in warehouses awaiting shipping orders, or newly introduced products which fail to move as rapidly as predicted (and there are many such episodes) would be dated when they finally (at long last) reach the shelf as though they were fresh merchandise. This will compound the so-called problem you are trying to control. The housewife knows from experience which brands are freshest, made regularly with exacting controls, and will purchase such merchandise if she is quality conscious. If she is economically minded, she will buy on price, knowing full well that the quality may not be the best. No dating of product at time of shelf display will do anything more than confuse her. Hence, I would urge you and your associates to delete this recommendation from your report. Indeed, while your study does a fine job of explaining specific manufacturer practices, there is very little (if any) analytical foundation to support your recommendation for date of shelf display labeling...."

EGGS

I. INTRODUCTORY REMARKS

Eggs are commonly used as home-prepared foods because they are easy to prepare and are nutritious. The normal household condition of eggs is in the shell; however, institutional caterers are using frozen eggs which are thawed to liquid form before use in their establishments. This frozen egg form may in time become used in the home. Eggs are refrigerated in most large retail stores. The practice of selling nonrefrigerated eggs exists in small outlets and in roadside markets. Eggs are used in many forms: dried, frozen, etc., as are milk solids in many processed foods because of the rheological properties they impart to such foods. These forms will not be covered in this survey.

II. SUMMARY OF RECOMMENDATIONS (see also section IX)

A. The New Jersey Department of Health should adopt the coding recommendations for each packaged unit of the FDA Good Manufacturing Practices, Federal Register, April 26, 1969, for processed foods. Revelation of all such codes should be made by manufacturers to the New Jersey Department of Health on its request. A suitable coding system might be: date of packaging as a four-digit numerical code, first two digits for month, second two for day, e.g. 0405--April 5.

B. Egg-handling practices, processing, and storage "requirements" should be established by the New Jersey Department of Health.

C. Use instructions printed on all egg cartons and cases,--"Store under refrigeration (38°F.)." All cases and overwraps should be clearly marked for stock rotation with a date of packing, i.e., month, day, and year.

D. Date of shelf display should be printed on all egg cartons for stock rotation.

E. With the recent development of various modern types of other egg-processing facilities (e.g., freezing, drying) microbiological "standards" or "requirements" should be established by the Department of Health to cover such operations and prevent health hazards.

F. Voluntary expiry dating should only be used with a clear statement of such intent, and policing of such by interested concerns, with permission of the New Jersey Department of Health.

III. TYPE OF FOOD AND PRODUCT GROUPS

Eggs constitute a major department in supermarkets and represent 2.04 percent of total supermarket sales (12). They are sold in various grades, in dozens, and are packaged in paper or plastic cartons.

IV. TYPE OF PROCESSING AND PRESERVATION

A. Principles

The basic principles in the preservation of eggs depend on the control of microbiological, temperature, and packaging factors.

B. Processing

Most eggs move as fresh eggs from producer to retailer without intermediate storage. Egg production has become a steady, year-round industry, without major peak times. This has been accomplished by the introduction of modern methods of production and a general concentration of the egg-producing industry in more favorable climatic conditions, such as exist in the southeastern part of the United States.

The major part of the U.S. egg-producing industry is now equipped with large hen houses, some with year-round air conditioning in which maximum sanitary measures are observed and from which the eggs are produced in relatively clean condition. Eggs for the consumer market are usually mechanically washed, sanitized, and dried. They are candled and mechanically graded for size, and then packaged and refrigerated. The unit operations in egg-handling are shown in figure 8.

The washing procedure, while simple, must be done according to basic sanitary requirements, since improper washing can readily infect eggs with bacteria. Other practices are described in sections V and VI below.

Eggs from farms which do not possess large-scale equipment for washing or adequate refrigeration facilities may enter the consumer market without the stability associated with eggs from larger and more reputable processors.

V. QUALITY CHARACTERISTICS AND VI. PROCESSING AND STORAGE QUALITY LOSS FACTORS

A. Identification of Potential Causes of Quality Losses

The quality characteristics required of eggs for the consumer market are: (1) appearance, (2) odor and flavor, (3) nutritive value, (4) microbiological condition, and (5) functional properties.

In accordance with some of the above requirements, eggs may be voluntarily graded for quality by the Consumer and Marketing Service, USDA. These quality grades are based on size of the air cell, cleanliness and soundness of the shell, centering of the yolk, and clarity and firmness of the white. The firmness of yolk and white is measured in terms of thickness after the egg is broken out of the shell, and is expressed in terms of Haugh units (figure 9). The following grades are established: AA, A, B, or C. A separate voluntary grading may also be made for weight per dozen into one of the following designated classes: jumbo, extra large, large, medium, small, and peewee. For example, "large" eggs weigh 24 ounces per dozen and "small" eggs weigh 18 ounces per dozen.

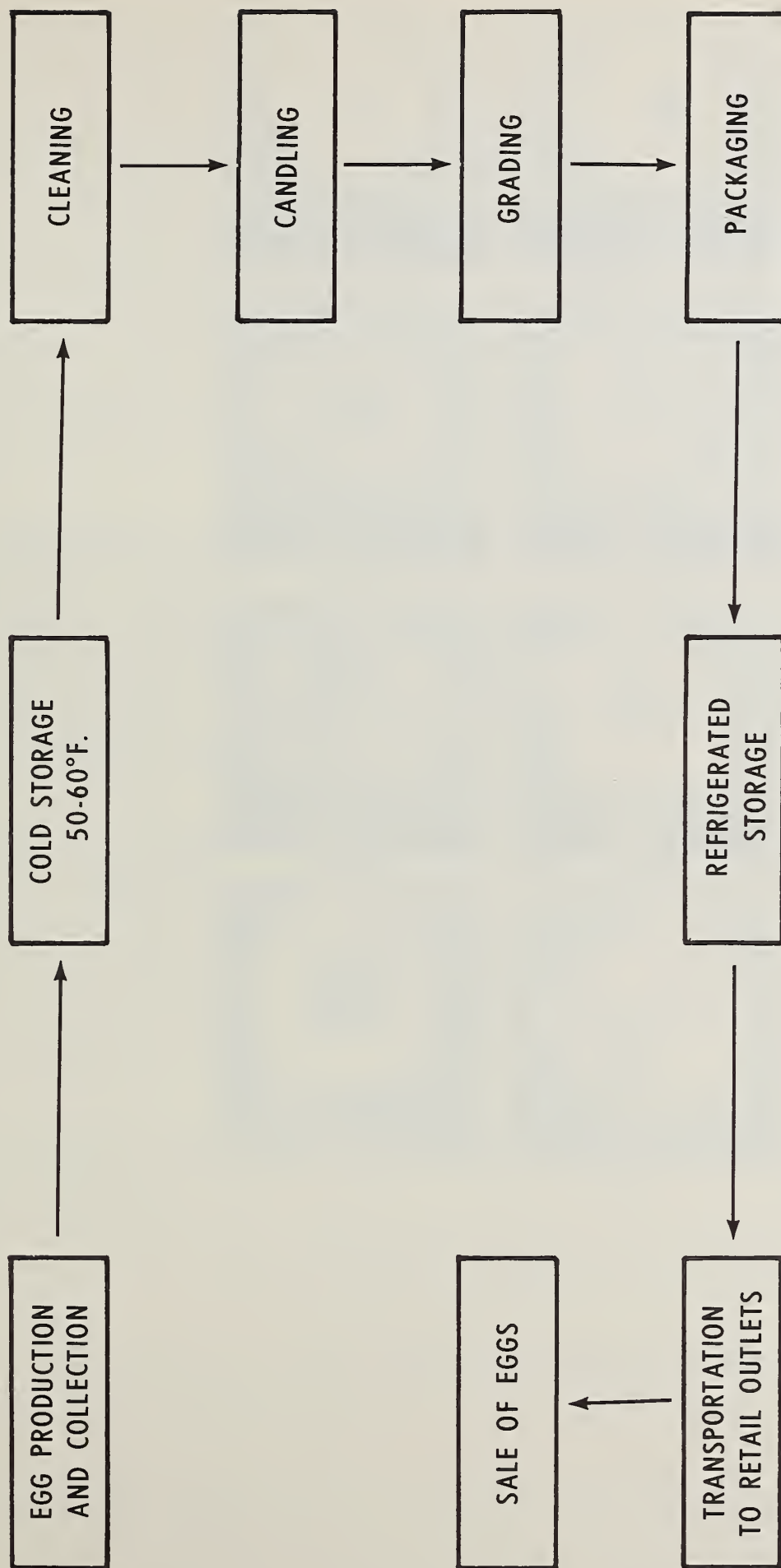


Figure 8.--Unit operations in egg handling

Source: Adapted from Blake (1).

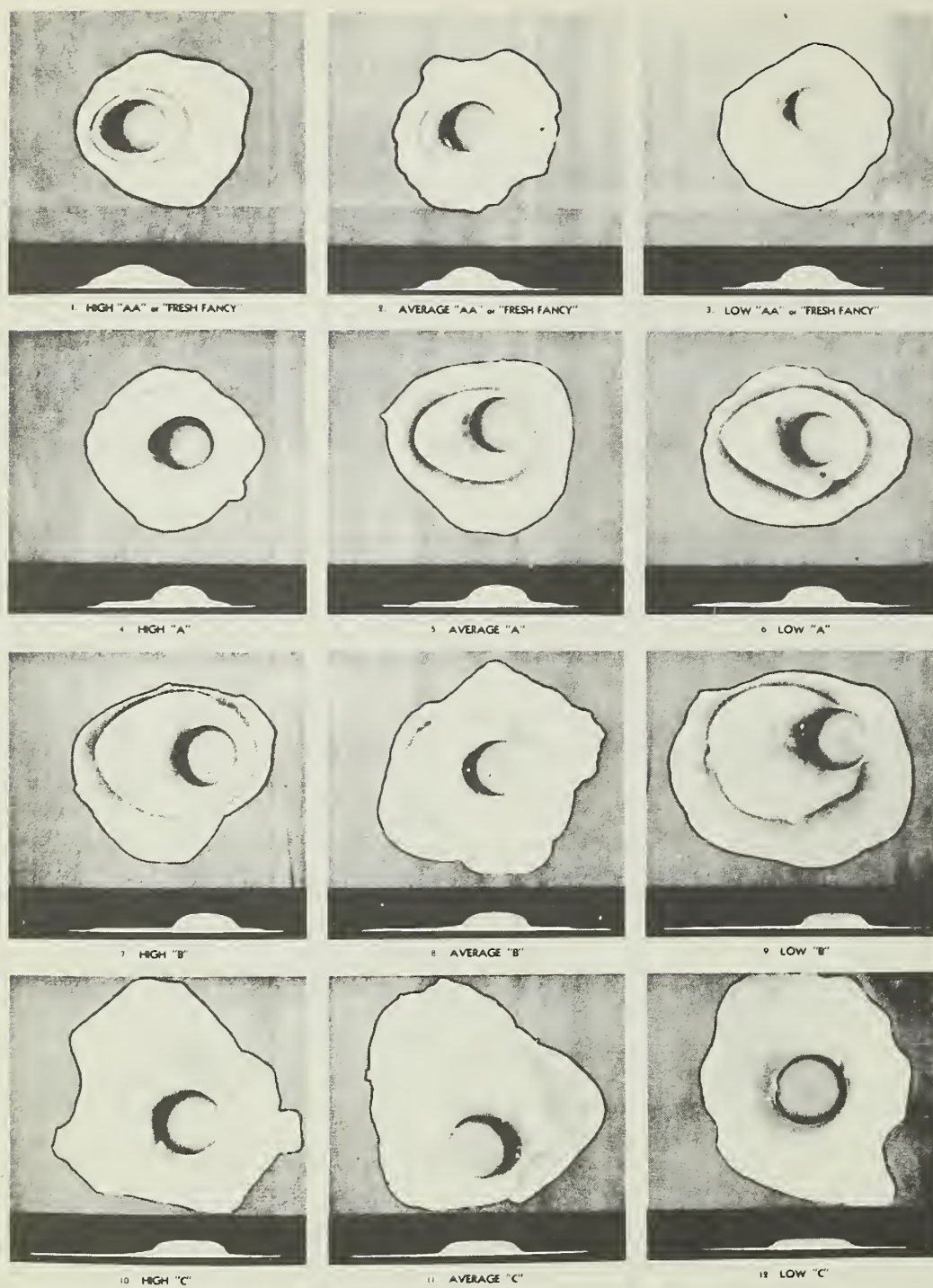


Figure 9.--Changes in interior quality of eggs on aging

Source: U.S. Department of Agriculture (2).

The following discussion of quality factors also identifies potential causes of quality loss.

Appearance.--The external appearance of eggs, while largely aesthetic, does reveal some defects that may be present. Cracks, which may have been present since the time of laying or have occurred shortly thereafter, may allow bacteriological infection to enter the egg. Shell color is dependent on the variety of hen producing the egg, and has nothing to do with egg quality. Yolk color is dependent on type of feed and has no relationship to nutritional quality. When removed from the shell, fresh eggs have whites that are higher and have a smaller diameter than the same egg when older (the basis of Haugh Unit measurement). Similarly, the yolks are thicker and of smaller diameter when fresh. These characteristics change with age and are influenced by storage temperature and relative humidity conditions. They are discussed further under functional properties.

Odor and Flavor.--Characteristic odor and flavor normally associated with fresh eggs may be altered by absorption of foreign odors, either during storage or transportation. According to the ASHRAE Guide and Data Book (3), "So-called 'storage flavor' in eggs can be largely controlled by choosing cases, fillers, and flats which are new and which are relatively free of odor when moist." Foreign odors may be picked up when eggs are stored with other food products, e.g., potatoes, onions, citrus fruits, and cabbage. During aging, there is some loss of the original characteristic flavor.

Nutrition.--Nutritionally speaking, "the protein content of eggs is relatively constant, but the hen's ration has an important influence on the vitamin content (4)." Eggs suffer some nutritional losses during prolonged cold storage at 0°C. (32°F.), as shown in table 14. These storage times may, however, be considered excessive by today's standards of production and raise questions on the relevancy of such data. However, according to Rice (6), there is a gradual loss of protein during storage at 0°C. (32°F.). Since the data in table 14 resulted from long-term storage, it is assumed that losses in today's short-time storage are noticeably less.

Microbiological Conditions.--Microbiological spoilage is usually not a problem in sound eggs, handled or stored under adequate conditions of temperature and relative humidity. Some spoilage may result when dirty eggs are improperly washed, e.g., when wash water temperature is low and too near the temperature of the eggs themselves. Water temperature should be 40°F. above that of the eggs.

Cracked eggs, which should be eliminated during candling, can readily admit bacteria and mold spores, and spoil. If cracked eggs frequently appear in a retail outlet, the source of supply should be investigated.

Salmonella bacteria are common to poultry environment as well as to general atmospheric conditions. Large responsible egg producers take various protective measures to destroy these bacteria, such as specifying chicken feed free of salmonella organisms, maintaining clean cages, keeping eggs clean at every stage, eliminating cracked eggs early in the candling, washing and sanitizing the eggs properly, and storing eggs at refrigeration temperatures.

Table 14.--Loss of vitamins in shell eggs in cold storage at 0°C.

Vitamin	Unit	Fresh eggs	Stored eggs					
			3 months	loss	6-7 months	loss	12 months	loss
			Percent			Percent		
Niacin.....	mg/g	0.66	0.60	9	0.54	18	--	--
Choline.....	mg/g	14.9	14.4	0	15.4	0	14.9	0
Vitamin B ₆	ug/g	2.52	2.06	18	1.78	29	1.34	47
Riboflavin.....	ug/g	3.49	3.32	5	2.93	16	3.07	14
Pantothenic acid..	ug/g	12.5	11.7	6	11.7	6	11.8	6
Folic acid.....	ug/g	94	93	0	80	16	74	27
Biotin.....	ug/g	225	244	0	220	0	228	0
Vitamin B ₁₂	ug/g	6.54	6.07	7	6.17	5	5.03	23

Sources: Adapted from Morgan (5) and Evans (13).

Mold growth can be controlled by atmospheric storage with relative humidity no higher than 85 percent, according to ASHRAE Guide and Data Book (3), and by preventing sweating of eggs caused by transferring refrigerated eggs abruptly to warmer, more humid areas, as may occur during transportation transfer.

Functional Properties.--The functional properties of eggs change with storage time; the rate of change is dependent on storage temperature. The storage changes are discernible when eggs are removed from the shell. The yolks gradually flatten and the whites become thinner and their grade falls (figure 9) (2). These changes are particularly annoying when frying or poaching eggs, or when attempting to separate whites from yolks in baking and related household operations.

The functions of eggs as household ingredients include the following:

- (1) Leavening, as in making chiffon and angel food cakes.
- (2) Binding ingredients together, as in making croquettes and holding crumbs to the surface of fried foods.
- (3) Emulsifying an oily and a watery liquid, as in making hollandaise sauce
- (4) Thickening such foods as custards.

Since eggs are graded before distribution, they can be reduced at least one grade between grading and consumption (11).

B. Food Industry Practices for Quality Maintenance

The food industry, aware of the foregoing quality factors, has presumably established practices to counteract changes in quality. Several large operators use egg-washing equipment which automatically maintain water temperature 10-20°F. above that of eggs. The units include detergent and sanitizer stations. Washing is accomplished by adding a USDA-approved detergent, followed by a water rinse, and a treatment with a chlorine or iodine antiseptic sanitizing solution.

Eggs are normally cooled immediately after laying 1/ and, except for washing temperatures, are kept in cold storage, 50-60°F., until sold (7, 8). Eggs that are not intended for long storage are best kept at 70 to 80-percent relative humidity. These conditions are suitable for 2-3 weeks storage, which is the interval that might elapse from production to consumer purchase. (However, air-conditioned stores and especially refrigerated cabinets may operate at lower relative humidities.)

C. Channels of Distribution

One major retail chain (#30FIS) made the following statements on eggs:

"(a) Transportation

Minimum delivery 3 times per week, preferably daily, refrigerated or cooled if possible during shipment.

(b) Warehousing and Storage

Highly perishable. Protect from heat. Determine quality by candling or breaking. Use refrigeration.

(c) Retailing--Storage and Display

Kept under refrigeration until sold."

D. Consumer Factors

The same retail chain reported it expiry dates its eggs for a 7-day shelf life, with allowance for reasonable home storage.

VII. PRESENT PRACTICES OF CODE DATING/PUBLIC DATING

A. Voluntary Food Industry Code Dating and Monitoring

Most suppliers of eggs to retail chains code their egg cartons with a cryptic code system. Several major chains in New Jersey code their egg cartons with a date, but the existence and purpose of the date is not publicized or stated. These stores informed the survey team that the dates are intended as expiry dates.

B. Legal or Required Dating

1. Federal--There are no Federal requirements for public dating. The FDA regulations contained in the Federal Register of April 26, 1969, Good Manufacturing Practices, indicated that FDA would like code dating in interstate and intrastate commerce shipments.

1/ The precooling of eggs immediately after laying and before cleaning does not affect their quality, according to a May 1969 group publication of Extension Specialists from four universities (8).

2. State--Twenty-one States have egg-dating requirements of some form. These states are:

Alabama	Iowa	New York
Arizona	Kentucky	Oregon
Arkansas	Louisiana	Rhode Island
California	Massachusetts	South Dakota
Colorado	Michigan	Tennessee
Florida	Mississippi	Texas
Illinois	New Hampshire	Washington.

Further information is contained in the Legal Report, appendix I.

Some examples of State egg-dating requirements from the survey files follow:

(a) California Food and Drug Title 220.51, Register 67, #43 10-28-68, states:

"Part 1. Egg Products

"11350. From Other States. (a) Egg products received in California but prepared outside of the State and within the United States, must bear a certificate of an authorized representative of any Federal, State, county, or city department that is authorized to inspect food products, which certificate shall state that the egg products have been prepared from eggs fit for human food and in accordance with the sanitary laws of the place of origin.

"Egg products shall be prepared only from eggs that are fit for human food, under sanitary conditions that meet the approval of all State rules and regulations prescribed under authority of the California Pure Foods Act and the California Food Sanitation Act.

"The certificate issued by any authorized representative shall report thereon, all details as to:

- (1) Name and address of packer.
- (2) Date of cracking (breaking is a more common term)
- (3) Date of freezing (or drying, etc.).
- (4) Condition of raw material.
- (5) Condition of finished material.
- (6) Over-all sanitary conditions of plant on date of cracking.
- (7) Code or batch number corresponding to numbers on each can.

"(b) The California Pure Foods Act requires, in addition, that each can bear a label listing the following information:

- (1) Name and place of business of the manufacturer, packer, or distributor.
- (2) A statement of the quantity of the contents.
- (3) Common or usual name of the food.
- (4) The common or usual name of each ingredient if the food is fabricated from two or more ingredients.

"(c) The shipment shall be accompanied by a carbon copy of the certificate, which shall be held at the warehouse where stored in the State of California. The consignee shall forward to the Chief, Bureau of Food and Drug Inspections, 760 Market Street, San Francisco 2, California, the original certificate covering the shipment in question.

"11355. From Other Countries. (a) All importers and wholesale distributors of egg products imported into the State from without the United States shall include in their report to the Department of Public Health when the eggs are received the following information:

- (1) Quantity
- (2) Kind of egg products
- (3) Type of container
- (4) Place where stored
- (5) Date received
- (6) Case number.

"(b) The report to the State Department of Public Health within five days after the sale of these egg products shall include the following:

- (1) Quantity
- (2) Type of egg products
- (3) Type of container
- (4) Date sold
- (5) Name and address of person or firm to whom sold
- (6) Case number
- (7) Department of Public Health certificate number."

California's Food and Drug Title #17, Register 67, #48, 12-2-67, 220.57, with respect to the type of egg products requiring coding, also stipulates the following:

"(r) Containers. Liquid or frozen egg products shall be packaged only in the following types of containers:

- (1) New tin egg cans of 30 lb. or less capacity.
- (2) Containers, other than tin egg cans, may be reused without plastic liners provided they are of sanitary construction and have been washed and sanitized prior to use.
- (3) Clean completely serviceable cardboard or fiberboard containers with new polyethylene liners. There shall be no reuse of plastic liners.
- (4) Plastic liners shall have a minimum thickness of 2 mil. If 2 or more liners are combined the combined thickness shall be at least 2 mil. The outside of the container shall be free of liquid egg or other residue.

"(s) Coding. Each container for pasteurized egg products shall bear a code which will provide the following information:

- (1) Date of pasteurization (day and year).
- (2) Identification of the plant.

(3) Identification of product (i.e., whole eggs, egg yolks, egg whites, etc.).

(4) Code shall be marked on body of container in indelible ink, paint, or other suitable material.

(5) Code must be filed with the State Department of Public Health."

(b). Michigan Department of Agriculture Regulation #532-R285.532.8, packaging and labeling requirements, contains the following information:

"(5) Each container, package, or subdivision thereof which may be opened shall contain on the principal panel, either by printing or sticking tape, in distinctly legible form a date, stated as the month and day or the number of the month and day, preceded by the letters 'exp.' or a statement such as 'not to be sold after,' or a number which is the day of year. The date shall not exceed 10 days from date of Haugh Unit measurement test or candling, excluding the day of testing, except that the expiration date shall start with the date of packing for those shipments received during the interim between the weekly Haugh Unit test, provided such eggs are packed prior to the next weekly test. Upon expiration of the 10 days, the eggs shall be removed from the labeled packages or the Michigan seal of quality identification and expiration date shall be completely obliterated."

Note that no means for disposal of egg products is suggested.

C. The Department of Agriculture of the State of Oregon, Chapter 632. "Grades, Standards and Labels for Eggs," 1967 replacement part, has statutes for eggs as follows:

"632.770 Labeling of containers, subcontainers and placards. (1) it shall be unlawful to prepare, pack, place, deliver for sale or sell eggs in bulk or in containers or subcontainers:

(a) Unless each container or all subcontainers within each container of eggs are marked with the full, correct, and unabbreviated designation of size and quality of eggs therein according to the standards as prescribed by the department together with a date code for identification and the name and address of the producer, wholesaler or retailer by or for whom the eggs were graded or packed.

(b) Which are mislabeled.

(c) That are or contain inedibles and which are not denatured."

"(2) Only one description of the size and quality of eggs shall appear upon a container, subcontainer or placard required by ORS 632.705 to 632.725, 632.735 to 632.745, 632.760 to 632.805 and 632.810. Designations of size and quality required by this section to be marked upon containers of eggs shall be plainly and conspicuously marked in bold-face type letters:

(a) Not less than one-fourth inch in height on the outside top face of each container holding less than 15 dozen eggs, and

(b) Not less than one-half inch in height on one outside end of any oblong container holding 15 dozen or more eggs and on one outside side of any other container holding 15 dozen or more eggs. [1965 c.582 § 9]"

"632.755 Exceptions to ORS 632.770. (1) No markings, as prescribed in ORS 632.770, are required on containers or subcontainers of eggs:

(a) When sold at retail from a properly marked bulk display and packaged in the presence of the purchaser for the immediate purpose of the sale.

(b) When packed for sale to the Armed Forces or Federal agencies if labeled with United States Department of Agriculture grades.

(c) When packed for shipment or being shipped to points outside of the State of Oregon.

(d) When occasional sales are made as prescribed by the department to consumers by the producer from eggs produced and delivered on his own premises.

(e) When the containers and subcontainers are packed and certified in accordance with the standards of grade and quality and the grading rules promulgated by the United States Department of Agriculture.

(f) When being delivered from outside of the State to dealers in the State for candling and grading.

(g) When being delivered to or when in possession of a dealer for candling and grading, or when being delivered to cold storage, when in cold storage, or being removed therefrom."

"(2) Eggs when marked with United States Department of Agriculture grades such as referred to in paragraphs (b) and (e) of subsection (1) of this section shall be considered as complying with the provisions of ORS 632.705 to 632.725, 632.735 to 632.745, 632.760 to 632.805 and 632.810 if the eggs so marked as to grade and size meet requirements of the comparable quality grade and size designation according to the standards prescribed by the department. In no case may eggs so marked with United States grade designations be of a lower quality or size than comparable grades or standards prescribed by the department. [1965 c.582 §10]"

"632.780 Container to show grade or egg seal; exceptions. (1) it shall be unlawful to sell eggs for human consumption:

(a) Without notifying the consumer or purchaser of the exact grade or quality and size or weight of the eggs, according to the standards prescribed by the department, by stamping or printing on the container of the eggs such grade or quality and size or weight; or

(b) If the eggs are sold, offered or held for sale, in bulk, without displaying in a conspicuous place on the container from which they are

offered or exposed for sale, a sign in printed or other prescribed lettering not less than 2 inches high, giving the grade or quality and size or weight. The container in which such eggs are placed for the convenience and use of the consumer or purchaser, before removal from the store or place of sale, shall have the Oregon State egg seal imprinted thereon, placed therein, or attached thereto by the person selling such eggs, as shall be prescribed by the department."

"(2) The provisions of this section shall not apply to a person selling eggs of his own production, except when they are sold at retail to the consumer. This section shall not affect or apply to the sale of eggs by the producers when the consumer purchases and receives them at the place of production. [1965 c.582 §11]

"632.785 Mislabeling prohibited. It shall be unlawful:

(1) To sell or represent as chicken eggs, eggs from any other species of fowl, or mixed eggs from more than one species of fowl, or eggs from ducks, turkeys, geese, or any species of fowl other than chickens, without marking the containers and subcontainers of such eggs or otherwise indicating fully by sign, placard or other inscription the species of fowl from which such eggs were produced.

(2) To place or pack eggs in any containers or subcontainers bearing any name, marking of any designation of brand quality, grade or other matter, unless all of such markings which do not properly and accurately apply to the eggs placed or packed therein have been removed, erased or obliterated.

(3) To sell or use any container or subcontainer of eggs which bears a name, trademark or trade name which is obliterated or effaced, except where the seller or user is entitled to use such name, trademark or trade name.

(4) To sell or advertise eggs below the quality grade of grade A as 'fresh eggs,' 'ranch eggs,' 'farm eggs' or to represent the same to be fresh. [1965 c.582 §12]

Note: This is required code dating, but it does not specify what type it should be, i.e., date of expiry, date of packing, date of laying, date of sale, or whether it be also openly dated (in the survey, code dating generally means cryptic coding). The same requirements have many other exceptions from those detailed above.

(4) The State of Washington Order #941, April 1, 1964, Rules and Regulations Relating to Eggs and Egg Products deals mainly with handling practices and regulations relating to the processing of liquid, frozen, and dried eggs and egg products."

(3) Municipal--No requirements located.

(4) Foreign--Foreign requirements on code or public dating are included in appendix II of the Legal Report.

C. How Dating Influences Quality Maintenance: Advantages and Disadvantages of Dating

Dating, whether voluntary or required, does not influence the quality maintenance of eggs. The factors influencing quality are primarily those of temperature, processing practices, and other factors as discussed in preceding sections. Of these, temperature and sanitation are most important. Expiry dating as practiced by chain stores can only be effective if processing and storage practices are adhered to, and should be specified as to type of dating by all who wish to use such forms of dating. Eggs should not be expiry dated voluntarily unless systems for such are presented to the New Jersey Department of Health authorities and the facts are demonstrated to be scientifically sound by the persons requesting the introduction of such dating systems. The requestors should be required to police and adhere to any promised practices. In general terms, it should be understood that the food industry cannot guarantee shelf life of products unless all their practices and the channels of distribution are technically controllable. Even if this guarantee were possible, the food industry would have to state the following on labels of all its foods. "The producer guarantees the storage life of this product ONLY IF HANDLED in accordance with directions for storage and use." Of course, such a statement and situation applies not only to eggs but to all foods.

Several large chain store companies do date their egg cartons.

Company (#530FIS) dates them with an expiry date for 7 days shelf life, with allowances made for reasonable home storage.

Company (#440FIS) puts an expiry date on its cartons.

Company (#30FIS) puts a date on its cartons which, according to the survey team, seems to be the expiry date.

VIII. FOOD PRODUCT ITEM LIST--SHELF LIFE

A. Scientific Source

The effect of storage temperature on quality of eggs is shown in figure 10.

IX. RECOMMENDATIONS ON BEST MEANS OF FOOD QUALITY MAINTENANCE

Where open/expiry dating has been established by individual companies for their own store use, its continued practice should be encouraged only under the conditions described in section VII, subsection C. As noted previously, open or expiry times should include sufficient (at least 7 days) home storage time, and the date used should be stated as an expiry date with provision for 7-days refrigerated home storage. If these conditions do not exist, the date of shelf display instead of expiry dating should be used.

Note that expiry dating will not protect the consumer from getting eggs of unsatisfactory functional and flavor quality when these defects are caused by

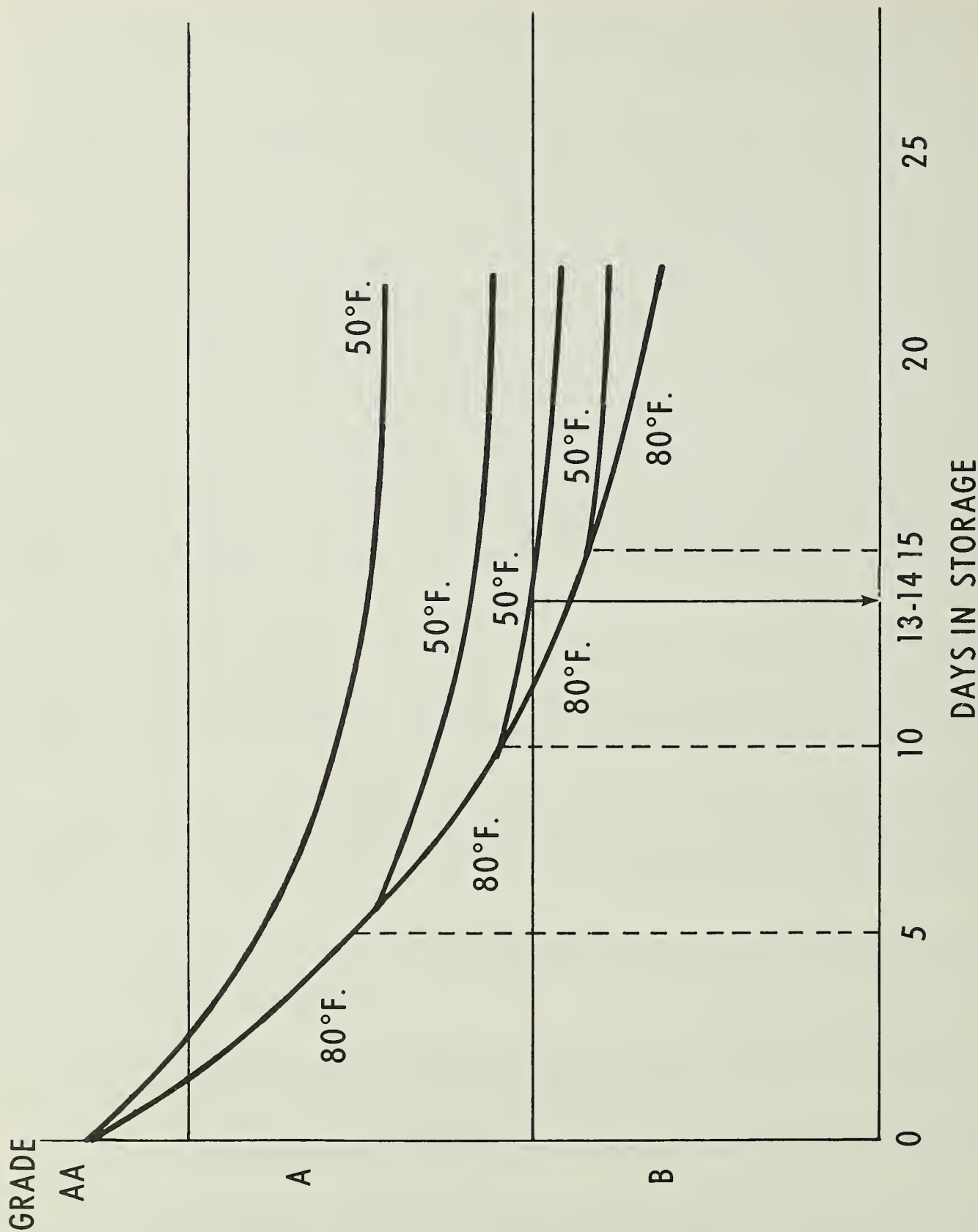


Figure 10.--Effects of storage temperature on quality breakdown of eggs

Source: From data of the Department of Poultry Husbandry, The Pennsylvania State University

improper temperature and relative humidity during short-term storage. Dating will also not protect eggs against a loss in quality owing to the presence of cracked shells or of improper washings.

Dating will not help the customer to differentiate between eggs stored for a long time at low temperature and those that are fresh or have not been refrigerated. It could, however, assist the merchant in rotating his stock, thus giving the consumer some protection against buying eggs inadvertently left in the display area, and aid the consumer in home storage rotation and use.

Handling practices, processing, and storage requirements could be readily assembled by examining the requirements of other States, and should be promulgated by the Department of Health for all egg producers and processors.

Eggs which are officially graded by the USDA have a date of grading. Since not all eggs are USDA-graded, it is recommended that all eggs be openly dated on the case as to day, month, and year to permit storage rotation. All egg cartons should have the storage instruction, "Store under refrigeration 38°F."

X. REFERENCES

- (1) Blake, J.A., "Preprocess Handling of Eggs," Proceedings of Rutgers University Liquid Egg Processing Course, Atlantic City, N.J., March 1966.
- (2) U.S. Department of Agriculture, Egg Grading Manual, USDA Agriculture Handbook No. 75, rev., Washington, D.C., 1969.
- (3) American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc., ASHRAE Guide and Data Book--Applications for 1966 and 1967, New York, N.Y., pp. 671-674.
- (4) Watt, B.K., Merrill, A.L., and Orr, M.L., "A Table of Food Values," in Food. The Yearbook of Agriculture 1959, U.S. Department of Agriculture, Washington, D.C., 1959, p. 235.
- (5) Morgan, A.F., in Nutritional Evaluation of Food Processing, by R.S. Harris and H. von Loesecke (eds.), John Wiley and Sons, Inc., New York, N.Y., 1960, p. 448.
- (6) Rice, E.E., in Nutritional Evaluation of Food Processing, by R.S. Harris and H. von Loesecke (eds.), John Wiley and Sons, Inc., New York, N.Y., 1960, p. 102.
- (7) Refrigeration Research Foundation, Commodity Storage Manual.
- (8) University of Massachusetts, Cooperative Extension Service, An Evaluation of Commercial Shell Egg Processing Methods, Pub. No. 34, Amherst, Mass., 1969.
- (9) Poultry and Egg National Board, Eggs--Basic Information for Young Homemakers, No. 220-24.

- (10) U.S. Department of Agriculture, Eggs in Family Meals, Home and Garden Bulletin No. 103, revised December 1967.
- (11) Slosberg, H., Vice President of Research, Henningsen Foods Inc., New York, N.Y.
- (12) Chain Store Age, 1969 Supermarket Sales Manual, Lebhar-Friedman, Inc., New York, N.Y., July 1969.
- (13) Evans, R.J., et al., Poultry Science, 30:132 (1951); 30:515 (1951); 31:269 (1952); 31:377 (1952); 32:680 (1953); 34:922 (1955); and Journal Agricultural Food Chemistry, 1:170 (1953).

Chapter 11

OIL PRODUCTS

I. INTRODUCTORY REMARKS

Oils and fats, basic components of man's caloric diet, have been used since time immemorial as food, as a food ingredient, and in preparation of other foods. They are available from animals, plants, and marine sources, and their oxidation stability decreases in the same order of origin. Today, however, technology has increased their stability, making them more stable foods. Nutritionally, they are energy storage compounds continuously being synthesized, broken down, and reassembled in the human body. In recent years, they have attracted much medical and consumer interest because of their possible relationship to arteriosclerosis. Data, however, are insufficient to establish the authenticity of some of the claims against them and their several forms, i.e., unsaturated versus saturated. Thus, some of them are considered "possible" rather than "probable" health hazards. However, highly oxidized fats and oils, i.e., very advanced, are known to be toxic to animals.

II. SUMMARY OF RECOMMENDATIONS (see also section IX)

A. Adoption by the New Jersey Department of Health of the Coding Recommendations of the FDA Good Manufacturing Practices for processed foods, Federal Register, April 26, 1969. Disclosure of code meanings by food manufacturers to the New Jersey Department of Health on request by the latter.

B. Adoption of the open date of manufacture labeling for all outer cases/overwraps, etc., to assist in stock rotation.

C. Coding of all individual containers in such cases by the food industry with codes of its own choosing (similar in intent to A. above). Such codes should indicate plant location, date of manufacture of final product in container, shift, production line, and any other aspects of products, at the manufacturer's discretion.

D. Stamping of date of shelf display by retail stores for stock rotation and as a consumer aid in home storage stock rotation.

E. Expansion of instructions for consumers' use and storage (see section IX, subsection B, No. 1-4).

III. TYPE OF FOOD AND PRODUCT GROUPS

Oil products, by group, category, and variety 1/

<u>Product group</u>	<u>Percentage of total sales</u>	<u>Product category</u>		<u>Percentage of dept. sales</u>	<u>Percentage of total sales</u>
Oils and shortening	.56	Cooking & salad oils	<u>2/</u> 13.5	62.2	.348
Margarine	<u>.99</u>	Shortening	<u>2/</u> 8.2	37.8	.212
	<u>1.55</u>	Margarine	<u>3/</u> 8.8	<u>100.0</u>	<u>.990</u> 1.550

1/ For butter, see chapter on Milk and Milk Products.

2/ Percentage of dept. sales from "Baking Needs," Chain Store Age (5).

3/ Percentage of dept. sales from "Dairy Products," Chain Store Age (5).

Source: Adapted from Chain Store Age, 1969 Supermarket Sales Manual (5), Lebhar-Friedman, Inc., New York, N.Y., July 1969. (Used with permission of publisher.)

Oils and shortening may be divided into classifications of liquid (oils) and solid (fats). They may be further subdivided according to their source, i.e., whether of vegetable, animal, or marine origin.

The following is a representative listing of these products:

Liquid vegetable oils: Corn, soybean, cottonseed, peanut, sunflower, safflower, olive, sesame, and blends of these.

Solid vegetable shortenings: Usually blends of the above liquid oils, which have been partially hydrogenated. The main U.S. ingredient, however, owing to pricing functions is hydrogenated soybean oil.

Animal shortenings: Lard, tallow, butterfat, chicken fat, and turkey fat.

Fish oils: Cod liver, menhaden, and whale.

Margarines: Made from a variety of oils, together with water and water soluble ingredients, to produce a wide range of textural, flavor, and nutritional qualities. They must all conform to the Federal Standards of Identity, promulgated by the Food and Drug Administration of the U.S. Department of Health, Education, and Welfare (Federal Register 45.1, November 28, 1968).

IV. TYPE OF PROCESSING AND PRESERVATION

A. Principles

The principal intent of preservation of this product group is the inhibition of off-odors and flavors caused by rancidity.

B. Practices ^{1/}

The solid animal shortenings are usually recovered from meat tissue by means of rendering with heat, by wet or dry processes. These are relatively more saturated (lard 9-10 percent linoleic acid) at possible double-banding positions than are oils.

Vegetable oils, which are liquids and characteristically have free double bonds, are usually recovered from their sources by means of high-pressure extractors. Some oils are also extracted by use of nontoxic solvents, which are later removed by distillation from the extracted oil.

Following the rendering, pressing, or extraction, the oils normally go through several processes, including refining, degumming, bleaching, hydrogenation, winterizing, and deodorization. Not all oils and shortenings go through the same processes; e.g., olive oil often does not go through this refining process.

Hydrogenation, when needed, is effected by whipping (mixing) deaerated hot oil with hydrogen gas in the presence of a nickel catalyst. Hydrogenation hardens oils that are fluid at room temperature, and extends shelf life by reducing the presence of oxidation rancidification sites on the fatty acid-chain molecule. The degree of hardening can be controlled to cover varying degrees of consistency.

Liquid oils are poured into containers, which are usually of brown or clear glass. Some oils are packed in tin-plated cans; "plastic" shortenings are customarily packed in sealed cans. Storage of both varieties of these products is at ambient temperature prior to sale. The technique of nitrogen flushing of the head space voids of all containers to maintain product stability is widely applied.

Margarine is made in much the same way as butter. The process requires melting of the fats and mixing them with the oils. The other ingredients, including water or milk, salt, emulsifiers, color, vitamins, and preservatives, are brought into solution. Both portions are then put into a high-speed mixing chamber, whether for batch process or continuous process, to distribute uniformly the water droplets throughout the oil/fat mixture. Some margarine has air or nitrogen whipped into it to increase its spreadability. The semisoft product is then extruded and packaged in aluminum foil or plastic trays as in continuous buttermaking. Margarine is refrigerated throughout its storage life.

^{1/} No detailed description of the processing of oil products is given because of their variability, which depends on the specific product.

V. QUALITY CHARACTERISTICS and VI. PROCESSING AND STORAGE QUALITY LOSS FACTORS

Cooking, frying, shortening, and salad oils, as well as "plastic" shortenings, despite their high caloric value, are normally used primarily for their functional rather than nutritional qualities. Those currently sold vary considerably; some are more versatile and have many uses in the home. Oil products are used for cooking, frying, shortening in baked products, and use in salads. Some have additives to achieve various objectives, such as antioxidants to retard rancidity, or permitted silicones to improve frying (antispattering) characteristics. There is a varying tendency for all these oils to oxidize and become rancid, but the introduction of such permitted antioxidants as butylated hydroxyanisole, propylgallate, and others, stabilizes those oils which are more sensitive to oxidation. The effect of several of these antioxidants on the retardation of oxidation is illustrated in figure 11.

Shelf life can be expanded by using various means of purification (as required by the sensitivity of the particular oil or mixture of oils), by allowing the smallest void space possible when filling the container, and by properly sealing the bottle or can. The possibility of oxidation and rancidity occurs when the consumer opens the container, whether can or bottle. This early rancidity, which can develop in consumer storage, is caused by small amounts of oil left around the threaded part of the bottle or can and the cap. This surface oil, when exposed to the air, may oxidize and become rancid readily, possibly causing the consumer to suspect and even discard the entire contents of such containers. It is possible for the areas around the cap to smell and taste rancid while the oil remaining in the container is still of normal quality. The consumer can retard this form of spoilage, after opening the container and using some of its contents, by wiping the threaded portions of cap and container completely free of oil. A second precaution is to store the partially used oil in a refrigerator, at the risk of harmless crystallization.

Most refined oils have been "winterized," to prevent the partial solidification of the oil when refrigerated. Winterizing is the process of removing, by chilling, those oil components which solidify at refrigerator temperatures. Should an oil become cloudy in the consumer's refrigerator, there is no loss of functional quality except for salad use. In this case, the quality is readily restored when the oil is warmed to room temperature again. Exposure to sunlight or to fluorescent light may initiate the autoxidative chemical changes which can finally result in rancidity. It is advisable for both retailers and consumer to protect oils from exposure to both of these light sources.

Oil and shortening manufacturers are well aware of the great susceptibility of their stored oils to rancidity if they have been contaminated by certain metals, especially copper, even in trace amounts. Consequently, the edible oil industry practices considerable care and protects its products against such contaminants.

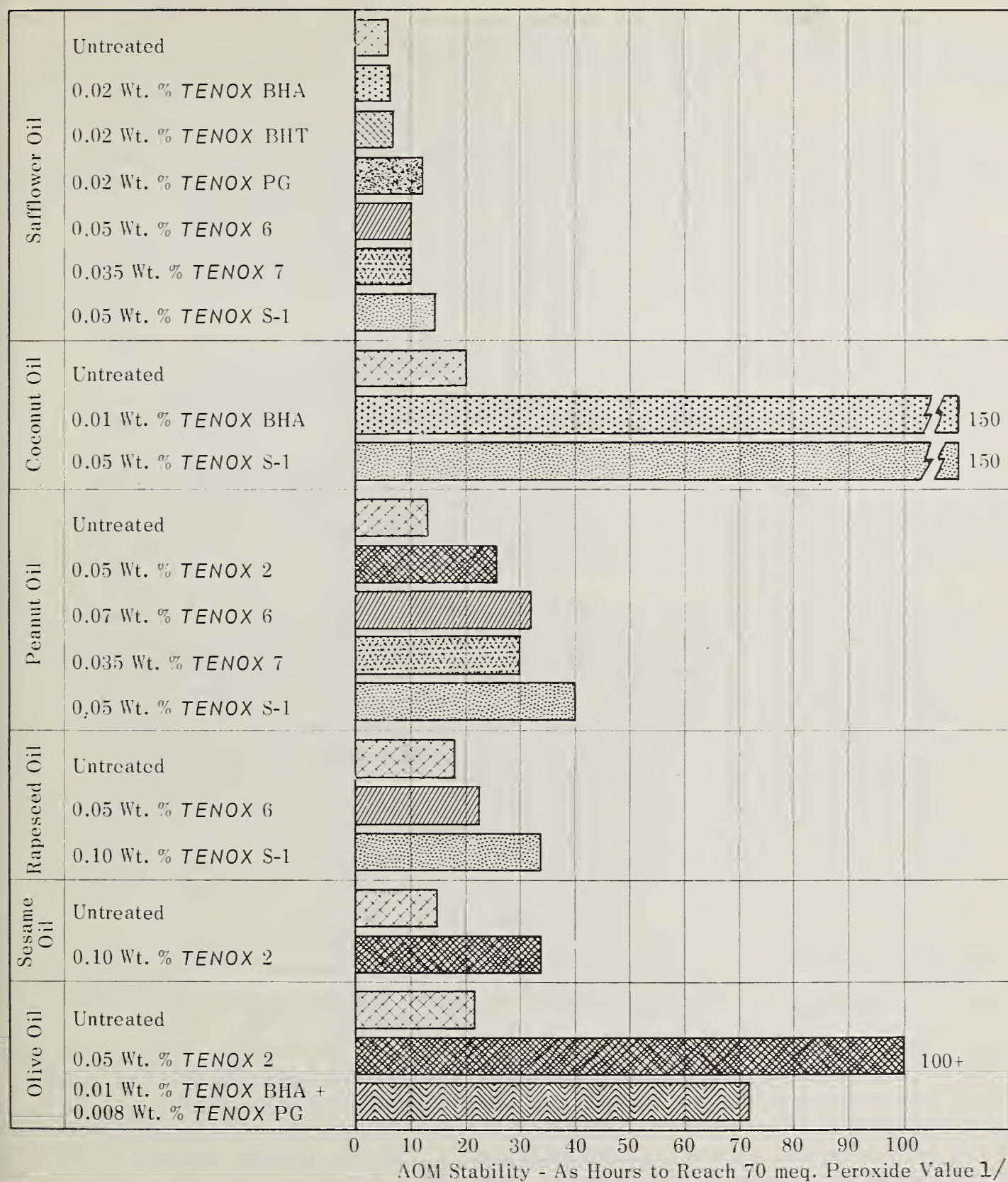


Figure 11.--Relationship of stability of various oils to use of antioxidants

1/ The Active Oxygen Method (AOM) is an accelerated test based on the exposure of a fat or oil held at 208°F. (97.8°C.) to a constant flow of air with periodic chemical measurement of the peroxide formed in the fat or oil during exposure.

Source: Reprinted from Pub. No. ZG-157 (6) with permission of Eastman Chemical Products, Inc.

Some oils are also used for their flavor; e.g., olive oil in salads. This oil usually is not deodorized.. Some vegetable oils have butter flavor incorporated in them, for sale in localities where this addition is permitted.

Some oils and oil products now on the market are high in polyunsaturates. Some of these were originally less stable against rancidity than others, but this vulnerability is normally guarded against by the addition of antioxidants. Another flavor hazard in aging of salad oil is the "reversion (beany, bitter, stale, off) flavor" that develops in soybean oil. Partial hydrogenation followed by winterizing to remove the selectively hydrogenated or hardened portions helps to reduce this cause of off-flavor.

Plastic shortenings, which are made from oils by hydrogenation, have been preferred in household baking, because of their uniform consistency. Stability of plastic shortenings is greater than that of liquid oils, especially since they are marketed in sealed containers. According to Feuge (1), "Hydrogenation also improves greatly the keeping quality of an oil. Conversion of cottonseed oil to an all-hydrogenated shortening can be accompanied by a tenfold increase in resistance to rancidity." Nevertheless, after opening the container, the consumer should be advised to refrigerate it, to minimize the chance of rancidity developing.

Of the animal shortenings in consumer use, lard (from porcine tissues) is the predominant one. It is used for its functional properties in baking, especially for products requiring a flaky texture. It has a characteristic flavor, which may be considered a desirable quality. This can be removed by deodorization if desired. A decrease in the quality of lard during storage is mainly caused by rancidity. This rancidity can be retarded by adding one or more of the antioxidants permitted by regulations (Part 18.7) of the USDA (2). These include butylated hydroxyanisole (BHA), butylated hydroxytoluene (BHT), nordihydroguaiaretic acid (NDGA), propylgallate, resin guaiac, and tocopherols. Lard does not require refrigeration during storage, transportation, and sales display but does on opening and during consumer storage.

Margarine is used primarily as a table spread, a frying medium, a shortening agent in baking and in cooking, and as a general substitute for butter. As a spread, it is soft enough at refrigerator temperature to permit spreading, and yet does not become fluid at normal ambient temperatures. Because of such spreadability features, it has replaced butter in many areas. According to the Standards of Identity of the FDA of the Department of Health, Education, and Welfare, it optionally may contain 15,000 U.S.P. units of vitamin A per pound, with or without accompanying vitamin D. It normally contains a preservative such as sodium benzoate. During proper storage under refrigeration, the quality factors are not lost, except for the possible development of rancidity.

Solid shortenings may appear rancid, if wrapped in paper or other porous type of wrapper which may be slowly penetrated by the shortening oils. These oils, after reaching the outer surface, oxidize and become rancid, giving the impression that the entire contents have become rancid, even though

the inner contents have probably changed very little. Knowledge of such permeation by the oil through the wrapper has led to the packaging of many of these products in fat-impermeable packaging materials, but not necessarily aluminum foil.

Fish oils, such as cod liver oil, were formerly used medicinally for their vitamin A and vitamin D content, but have now been largely replaced by concentrated capsule forms.

A food industry source (#120FIS) provided the following information on the quality characteristics and processing and storage quality loss factors of margarine:

"All of our margarines are periodically checked subjectively and objectively during processing and storage for those factors marked with an asterisk for the following quality characteristics:

- (a) Body and spreadability at refrigerated, room and elevated (95°F.) temperature.*
- (b) Mouthing characteristics or melt in mouth.
- (c) Flavor quality*, flavor balance, and color.
- (d) Vitamin content.*
- (e) Salt, moisture, fat and milk solids (if present) content.
- (f) Frying characteristics
- (g) Microbiological population* (total bacteria, yeast and mold).
- (h) Fatty acid composition or nutritional value.
- (i) Net content, in meeting label declaration.
- (j) Freedom from extraneous material."

"1. Identification of Potential Causes of Quality Loss
(in margarine)

- I. The use of old or inferior ingredients in processing can cause loss of quality, even before the end-item is made, and accelerate loss of quality as the product ages. Our company has strict quality specifications for all ingredients used, including age of ingredients and these are strictly observed.
- II. The age of the product and improper storage temperature can cause loss in quality. We observe maximum storage times of 4 weeks in our production plants under refrigeration and 4 weeks in distribution warehouse under refrigeration.
- III. The inadequacy of the package in protecting the product can be the cause of loss in quality. We use only the best quality of packaging material and all packaging material is tested extensively prior to approval for use. Care is also taken to get good tight closures during processing."

"2. Practices for Quality Maintenance

- I. Each of our plants refines and deodorizes the oil blends just prior to use in that same plant; i.e., no inventory oils are used. The shelf life of the product begins from the moment of deodorization.
- II. We do extensive quality control tests (subjective, objective, and microbiological) on all ingredients as received in our plants and prior to use, at various stages of processing, and on the finished products. In all cases, results of tests must conform to our high standards of reproducibility, organoleptic acceptability, functional value, stability, and nutritional value.
- III. We keep samples of each day's product and these are tested at regular intervals for retention of quality factors.
- IV. We make products to keep pace with specific orders."

"3. Distribution Cycle

I. Transportation

All margarines are transported from plant to warehouse and from warehouse to retail outlet via refrigerated trucks, and trucks must be in clean and sanitary condition. The only time unrefrigerated trucks are used is for short hauls of one to two hours, but product must be immediately unloaded and product refrigerated. Trucks must not contain any other highly odoriferous food products.

II. Warehousing and Storage

During warehousing, regular stock rotation (first in, first-out) is observed and product is to be stored at controlled temperatures of 40-50°F. Product should not be stored in areas containing soaps, cheese or other odoriferous materials. During warehousing case stocking, height shall not exceed 6 tiers on regular print margarine and 5 tiers on margarine filled into tubs. When using pallet racks, multiple-height pallet-stacking is permissible.

III. Retailing--Storage and Display

During retailing, most of our products must be stored and displayed in refrigerated cases. Our low-cost margarine made with fat of slightly higher melting point may be sold in the absence of refrigeration. On rare occasions we would permit floor displays of regular margarine in air-conditioned stores for short durations (1-2 days). Normally, our margarines are always refrigerated to protect polyunsaturates and flavor quality."

"4. Consumer Factors

- I. Consumers should always keep margarine refrigerated while not in use.
- II. The consumer does not always observe sanitary conditions while using the product, such as using the same knife for spreading margarine on bread as previously used for some other product such as cheese. This can cause off-flavors.
- III. The consumer may also store the margarine unprotected in a refrigerator containing highly odoriferous food products. This can cause off-flavors and odors."

VII. PRESENT PRACTICES OF CODE DATING/PUBLIC DATING

A. Voluntary Food Industry Dating Practices

The practice of open dating of this product group is not followed. All companies can code date their products.

One leading producer (#560FIS) of oils and shortenings codes products at the time of manufacture. The code contains production date, location of plant, shift, and production line. He states that production is monitored for field age and condition by purchase and examination of samples from all types of retail stores in various cities throughout the country. He also states that his sales force checks the field age of his products, rotates stock as required, and arranges to return overage stock to his plants.

This company's household shortenings, which are packed in sealed cans, with oxygen excluded, will keep indefinitely when judged by organoleptic methods. But if canned shortenings are stored at relatively high temperatures (90-100°F. or higher) for extended periods, the physical condition of the product may change--i.e., it will become darker and duller--and if it becomes completely melted, it may resolidify into a grainy semiliquid condition. Cycling storage from extreme summer to winter temperatures can result in similar changes with certain formulations. This may impair the cake-making ability of shortenings, but will not impair their usefulness for frying or cooking. These physical changes do not pose any health hazard. Whenever practicable, the company controls shipping and storage temperatures between 50 and 80°F.

Company #560FIS further states that its margarine will keep a year or longer at about 40°F. without any changes which would make it unusable by the consumer. On extended storage, margarines have a tendency to lose a little flavor palatability.

Food industry source #120FIS stated:

"Our margarine products are marked with a combined alphabetic-numerical code denoting the date the product is made. This code is put on the individual package and the shipping case."

Company #520FIS code dates all its products and has established a shelf life of 8 months on its oils. This does not mark the end of satisfactory shelf life but is used to alert merchants on stock rotation. Company #520FIS has set 4 and 5 months shelf-life time for its margarines. Such variations are the result of different rates of sales and formulations and processing. Here, too, this period does not mark the end of usable shelf life.

Company #480FIS lists storage times as follows for its oil products:

"Bottled oil, also in 2 and 5 gallon cans: 12 months

Oil in 'plastic' gallons: 6 months

Oil in gallon cans: 6 months

'Plastic' shortening: 9 months

Whipped 'plastic' shortening: 9 months"

These times are not shelf-life expiration dates, but points in time when, on the average, and at storage temperatures of approximately 70°F., product changes (quality declines) noticeable to expert evaluators occur.

The company's products are coded to designate ". . .the product packed, the plant at which it was packed, quite often the line on which it was packed, the date packed, and quite often the time of day period."

Company #530FIS, a leading supermarket chain, which either manufactures its own products or has them made elsewhere by specification under its own label, codes oils, shortenings, and margarines only for stock rotation purposes. Its shelf life is long enough not to face expiration during rotation on the shelves before sale.

Company #30FIS, another leading supermarket chain which either manufactures its own products or has products produced elsewhere according to its own specifications, under its own label, designates shelf life as follows, with allowance for ample consumer storage:

"Vegetable oils, in glass: 4 months

Vegetable oils, in cans: 6 months

Margarines: 60 days"

B. Legal or Required Dating

1. Federal--With the exception of the suggested coding practices of FDA, Good Manufacturing Practices, April 26, 1969, there are no Federal requirements. Federal requirements do exist for margarine with respect to Standards of Identity, FDA, Department of Health, Education, and Welfare.

2. State and (3) Municipal--No specific regulations on dating were found. Wisconsin, the dairy State, may have special requirements for this product group.

4. Foreign--Various requirements exist (see Legal Report, appendix II).

C. How Dating Influences Quality Maintenance: Advantages and Disadvantages of Dating

Dating, whether open or coded, cannot maintain quality. It is only a tool for judicious use in monitoring and retrieval systems. This is generally in agreement with food industry source (#120FIS), which stated:

"Code dating of products manufactured from aged oils are misleading as would be the case in dating products in retail outlets. Dating is relevant to each manufacturer's operations; dating of competitive products can be misleading if these are interpreted to provide data on comparative freshness and organoleptic acceptability. Many competitors do not have an oil-processing plant associated with a margarine manufacturing operation. Those lacking such facilities must maintain an inventory of processed oil; also, some time must be allowed for transportation of processed oils from distant suppliers to users and the supplier must maintain an inventory of processed oils to fill orders. Under such circumstances, oils may be up to 2 months old prior to packaging in many of our competitors' plants."

The variations in shelf life noted previously by food industry sources confirm these remarks.

VIII. FOOD PRODUCT ITEM LIST

A. Shelf Life--Food Industry Sources

<u>Food item</u>	<u>Time*</u>	<u>FIS No.</u>
Bottled oil	12M	480
Butter flavor oil	12M	480
Corn oil	4M	30

*Y=year; M=month; D=day.

<u>Food item</u>	<u>Time</u>	<u>FIS No.</u>
Lard	90D	30
Pail, plastic container	6M	480
Olive oil	4M	30
Shortening	Indefinite	560
Vegetable oil	4M	30
Margarine	3-4M	130
Margarine	60D	30
Margarine	6M	120
Margarine	1Y	560

The ASHRAE Guide and Data Book (4) lists lard (without antioxidants) as having approximate storage life of 4-8 months at 45°F.

The household shortenings of #560FIS will keep indefinitely with respect to organoleptic properties.

Margarines will keep a year or longer without any harmful change.

IX. RECOMMENDATIONS AND DISCUSSION ON BEST MEANS OF FOOD QUALITY MAINTENANCE OR IMPROVEMENT

A. Through Dating/Coding

Most of these products are currently being code dated by manufacturers. Here, as in other instances, no consumer protection is to be gained by having the manufacturer apply open dating to any type of product in this group. Instead, the plan suggested elsewhere to apply the date of shelf display by retailers would serve to assure needed stock rotation and to assure the consumer of receiving satisfactory merchandise. This is a reasonable conclusion since none of the products result in a health hazard as a result of long storage.

B. Other Means of Quality Improvement

The industry should also provide additional label instructions for home care on all these products where appropriate; e.g., (1) refrigerate after opening, (2) wipe tops of containers clean after use before storing, (3) do not store in a hot humid place, and (4) store in a dark place.

Such precautionary measures help reduce the onset of oxidation in clear containers.

Open public expiry or date of manufacture marking by the food industry is not recommended because no provisions are made by open dating for surveillance of temperature and other variables which are more important to shelf life and prevention of public health hazards.

X. REFERENCES

- (1) Feuge, R. O., in Nutritional Evaluation of Food Processing, p. 250, by R. S. Harris and H. von Loesecke (eds.), John Wiley and Sons, Inc., New York, N.Y., 1960.
- (2) U.S. Department of Agriculture, Consumer and Marketing Service, Regulations Governing the Meat Inspection of the United States Department of Agriculture, §18.7, Sections b, 1-9.
- (3) Karel, M., in Nutritional Evaluation of Food Processing, by R. S. Harris and H. von Loesecke (eds.), John Wiley and Sons, Inc., New York, N.Y., 1960.
- (4) American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc., ASHRAE Guide and Data Book, Applications for 1966 and 1967, New York, N.Y., p. 639.
- (5) Chain Store Age, 1969 Supermarket Sales Manual, Lebhar-Friedman, Inc., New York, N.Y., July 1969.
- (6) Eastman Chemical Products, Inc., Technical Data for the Food Industry, Publication No. ZG-157, Kingsport, Tenn.

XI. REPORT REVIEW AND COMMENTS

#120FIS stated in relation to margarine:

"In the first place, I agree completely with the conclusion drawn that a code marking giving the date of manufacture, as practiced by the food industry today, is adequate for all practical purposes. It is not in the consumers' interests to date, by an understandable calendar system, the day of manufacture...

"Secondly, I can endorse your position that shipping cases be dated by some understandable calendar system. As I had pointed out to you, we freely decipher our code to warehouse supervisors and the like to allow them to move stock properly; first-in becomes first-out.

"However, I cannot subscribe to your third recommendation, calling for a date to be stamped on the package of a food product as it is placed on the shelf of the retail grocery store. This serves no useful purpose and can, indeed, be misleading. The consumer will consider this date in relation to others, as an index of relative freshness. You can urge her as much as you like to compare such dates within only a given brand, but you know that the comparisons will go across brand lines. "Distress" but wholesome merchandise representing products that may have been held too long in warehouses awaiting shipping orders, or newly introduced products which fail to move as rapidly as predicted (and there are many such episodes) would be dated when they finally (at long last) reach the shelf as though they were fresh merchandise. This will compound the so-called problem you are trying to control. The housewife knows from experience which brands are freshest, made regularly with exacting controls, and will purchase such merchandise if she is quality conscious. If she is economically minded, she will buy on price, knowing full well that the quality may not be the best. No dating of product at time of shelf display will do anything more than confuse her. Hence, I would urge you and your associates to delete this recommendation from your report. Indeed, while your study does a fine job of explaining specific manufacturer practices, there is very little (if any) analytical foundation to support your recommendation for date of shelf display labeling..."

#560FIS stated:

"Most responsible food processors are highly conscious of food quality and are fully aware that it is to their advantage to get the freshest possible merchandise to the consumer. This, of course, is the main reason why products are coded, enabling an orderly and efficient national distribution with proper stock rotation even for products manufactured in a single location.

"Referring now to your specific recommendations, items 1 to 5 represent well thought out ideas and in most cases should prove beneficial to the consumer. Item 2, however, 'the adoption of the open date of manufacture labeling (DOM) for all outer cases/overwraps, etc., to assist in stock rotation,' can, in our opinion, lead to various difficulties and we would not be in favor of this recommendation.

"It has been our experience when State regulations are more stringent than Federal requirements for the same products, invariably the State concerned requires special treatment with an attendant increase in the cost of offering the product. Such a result is detrimental to the consumer who purchases the product. Uniform laws and regulations throughout the 50 states create, for the national marketer, the most efficient system for producing large volumes of goods at the lowest possible price to the consumer and, wherever possible, we foster such uniformity.

"The dating technique you propose might well force us to segregate production for the State of New Jersey at the time of manufacture or possibly redate at the time of shipment, obviously at an additional expense. If such a requirement were adopted on the Federal level or uniformly in the 50 states, or at least a majority of them, there might be no difficulty meeting the requirements. However, it is quite likely that other universities may be performing similar surveys in other states and we could be faced with a variety of state codes based on DOM, estimated shelf life, or whatever other criteria seem appropriate to the various investigators. Should other states pass laws which are inconsistent with New Jersey, we would be faced with many different labeling or marking problems, thus compounding the difficulties and increasing the costs.

"I also question whether DOM marking on outerwraps will achieve its intended goal without extensive confusion. In this regard, the store clerk controlling stock rotation by means of DOM could not help but develop a value judgment among several competitive inventories, based on the DOM rather than on actual stock quality. As manufacturer #120FIS so correctly stated in your report, there is not necessarily a correlation between age and organoleptic acceptability of competing margarines due to fundamental differences in oil handling. Preservative systems, warehousing and the like also affect quality. A basic producer will traditionally use only oils deodorized within 48 hours, while many manufacturers of margarine utilize oils often 4-8 weeks old. There is a substantial difference between the quality of margarine stored under favorable conditions prior to shipment by the manufacturer and those products which are not. Store personnel as a rule do not have the background to appreciate these differences and may be misled by attaching too high a significance to DOM..."

Dr. S. S. Chang of Rutgers University's Food Science Department, an outstanding scientific expert and researcher in fats and oils, noted after reading this section:

"I would like to call attention to the following, which may produce products whose effects upon human health are not clearly understood:

- (1) The use of fats and oils which have been damaged already before processing.
- (2) Conditions in processing which may damage the fats or oils.
- (3) Serious damage of fats and oils in some plants and many restaurants."

DESSERTS

The major department of dessert products consists of the following product groups:

- (A) Desserts and toppings
- (B) Spreads
 - (1) Peanut butter--product category
 - (2) Jams, jellies, preserves--product categories
- (C) Syrup, molasses, honey

Because of their diversity in composition, processing methods, and physical properties, these product groups are discussed somewhat separately under the above headings with the following exceptions: (i) section II, Summary of Recommendations of Product Group (A), contains data for (B) and (C) which follow; (ii) section III, Type of Food and Product Groups of (A), contains data for (B) and (C) that follow; (iii) section VII (B) 1-4, Legal or Required Dating of (A), contains data for (B) and (C) that follow; (iv) section X, References, is placed after the (C) product group as per the report format.

(A) Desserts and Toppings

I. INTRODUCTORY REMARKS

Most of this product group is normally sold in the form of mixtures of dry ingredients. Some of the completely prepared counterparts of these products, puddings in particular, are also currently produced in commercially sterile cans.

While desserts are usually not eaten as the main food item of meals, most of them have significant food value which consists mainly of such carbohydrates as sugars and starches, some protein, and in some instances fat. Exceptions are the dietetic desserts which are discussed in the section on dietetic foods. Some desserts are, however, served for their food value during illness or other abnormal circumstances.

Toppings are currently sold as dry mixes, frozen toppings, refrigerated toppings, toppings in aerosol cans, and toppings in glass containers. These, too, are mainly garnishes or adjuncts to principal foods.

II. SUMMARY OF RECOMMENDATIONS (see also section IX of product groups (A), (B), and (C))

A. Adoption by the New Jersey Department of Health of the coding recommendations of the FDA Good Manufacturing Practices, Federal Register, April 26, 1969, for processed foods. Disclosure of code meanings by food manufacturers to the New Jersey Department of Health on request by the latter.

B. Adoption of the open date of manufacture labeling for all outer cases/overwraps, etc., to assist in stock rotation.

C. Voluntary coding of all individual containers in such cases/overwraps by the food industry with codes of its own choosing (similar in intent to item A above). Such codes should indicate plant location, date of manufacture of final product in container, shift, production line, and any other aspects of products, at the manufacturer's discretion.

D. Stamping of date of shelf display by retail stores for stock rotation and as a consumer aid in home storage stock rotation.

E. Instruction for consumers' use and storage should be expanded. For (A), dry mixes for toppings should advise consumer on labels to keep refrigerated after preparation and before use, the use of the instruction "Do not store in a hot (over 70° F.) humid place" instead of "Store in a cool dry place." For (B) (1), "Do not store at over 75° F. or in direct sunlight" should be placed on labels of all products. For (B) (2), instructional statement on labels, "Clean mouth and lid of container with clean cloth after use; store in refrigerator (38° F.) with cap in place after opening." For (C), the instructions "Close after use to preserve flavor; store in warm (70-80° F.) dry area," should be printed on the package label.

III. TYPE OF FOOD AND PRODUCT GROUPS

Desserts, by product group, category, and variety

Product group	Percent- age of total sales	Product cate- gory	Percent- age of cate- gory sales	Percent- age of total sales	Product variety	Percent- age of depart- ment sales	Percent- age of total sales
Desserts and toppings	.51	Gelatin	38.1	.194			
					Flavored	33.6	.171
					Plain	3.3	.017
					Drinks	<u>1.2</u>	<u>.006</u>
						38.1	.194

Source: Chain Store Age, 1969 Supermarket Sales Manual (1), Lebhar-Friedman. Inc., New York, N.Y., July 1969. Used with permission of publisher.

Product group	Percent- age of total sales	Product cate- gory	Percent- age of cate- gory sales	Percent- age of total sales	Product variety	Percent- age of depart- ment sales	Percent- age of total sales
		Pudding & pie filling mixes	30.4	.155			
					Comb. pudd. /pie fill.	12.4	.063
					Pudding (instant)	10.5	.054
					Pie fill. (regular)	2.8	.014
					Refrig. pie mixes	2.6	.013
					Egg custard (reg. & no- bake)	2.1	.011
						<u>30.4</u>	<u>.155</u>
		Maraschino cherries	7.2	.037			
		Prepared toppings (not frost.)	5.3	.027			
					Chocolate	2.0	.010
					All other	3.3	.017
						<u>5.3</u>	<u>.027</u>
		Top. mixes	4.5	.023			
		Whipped des.	4.4	.022			
		Mincemeat	2.9	.015			
		Can. pudd.	2.8	.014			
		Tapioca	1.5	.007			
					Plain Pudding	.9	.005
						.6	.002
						<u>1.5</u>	<u>.007</u>
		Rennet	1.3	.006			
		All other des. mixes	1.6	.008			
			<u>100.0</u>	<u>.508</u>			
Spreads	.72						
		Peanut butter	47.6	.343			
		Jams & preserves	27.6	.199			

Product group	Percent- age of total sales	Product cate- gory	Percent- age of cate- gory sales	Percent- age of total sales	Product variety	Percent- age of depart- ment sales	Percent- age of total sales
					Strawberry	9.5	.068
					Raspberry	4.2	.030
					Grape	3.0	.022
					Blackberry	2.0	.014
					Peach	2.0	.014
					All other	6.9	.051
						<u>27.6</u>	<u>.199</u>
		Jellies	16.7	.120			
					Grape	11.4	.082
					Apple	1.1	.008
					All other	4.2	.030
						<u>16.7</u>	<u>.120</u>
		Marmalades	3.2	.023			
		Apple & other fruit butter	2.3	.017			
		Marshmallow spread	1.7	.012			
		All other spreads	.9	.006			
			<u>100.0</u>	<u>.720</u>			
Syrups molasses & honey	.24						
		Maple flavored syrops	44.6	.107			
					Plain	40.7	.098
					Buttered	3.9	.009
						<u>44.6</u>	<u>.107</u>
		Honey	19.6	.047			
		Corn & cane syrup	12.2	.029			
		Pure maple syrup	7.3	.018			
		Molasses	3.5	.008			
		Churned honey	2.4	.006			
		All other break- fast syrups	9.6	.023			
		Grenadine & bitters	.8	.002			
			<u>100.0</u>	<u>.240</u>			

IV. TYPE OF PROCESSING AND PRESERVATION

Gelatin desserts are essentially a mechanical mixture of sugars, gelatin, one or more "fruit" acids, such as citric or fumaric acid, natural or artificial fruit flavor or both, and color. Other ingredients, such as buffer salts used for accelerating the setting, may be added. Various improvements in technique have been adopted by several manufacturers to seal the flavoring material into the dry product. Except for the incorporation of liquid flavoring and coloring material, gelatin desserts are prepared by mechanically mixing dry ingredients to a uniform mixture. The product is usually packed in cartons lined with sealed coated paper liners. These coatings are frequently wax or polyethylene. At least one major manufacturer (#355FIS) is using heat-sealed polyethylene coated pouches which retain the flavors and aromas of the product for extended periods of shelf life. No further preservation is necessary. Storage is at room temperature.

Gelatin drinks are mixtures of liquid flavor and color adsorbed onto plain gelatin, which is then dried and packaged. Some gelatin-based products are also made with added fat by a spray-drying process to produce whip- and chill-type desserts.

The pudding and pie-filling mixes are essentially mechanical mixtures of sugars, starches, occasionally with vegetable gums, flavorings and seasoning materials, and at times approved coloring materials. These starches are often pregelatinized or processed with chemicals to promote rapid solubility. The uniformly mixed product is packed in cartons, usually with paper pouch liners. No preservation measures are needed. These products are stored at room temperature.

Cook-type puddings are made with one or more types of starches which require cooking for gelatinization. The instant puddings depend on pregelatinized starch for their thickening qualities. Both types, especially the instant-type products, are likely to contain one or more vegetable gums, such as those derived from algin, for desirable texture and mouth feel.

Lemon pie filling is processed essentially the same as puddings but with some modifications because of the presence of acid which may reduce the gelling property of the mixture during long shelf life. The particle size of acid crystals must be specified by the manufacturer to get maximum shelf stability.

Deluxe types of pie fillings, such as "chocolate cream" and "coconut cream" fillings, are like the basic pudding mixture but have a suitable fat added which gives the product a richer texture and mouth feel. These products, when prepared, may be whipped.

Egg custard mixes are dry mixes of dehydrated egg together with other sweetening and flavoring agents, and usually depend on a thickening agent such as algin. They are stored at room temperature.

Maraschino cherries are prepared by means of a process which completely changes the color, flavor, and texture from its original condition. Meticulous sanitary practices must be observed throughout the entire processing to prevent infection with yeasts and molds. Harvested cherries are bleached and firmed by storing them for several weeks in a brine containing sulfur dioxide for bleaching and lime for textural firming. Following this treatment, the fruit is washed to remove all but traces of the bleaching and firming agents. The cherries are then colored with FDA-approved dyes (specially sanctioned in the case of red color), after which they are immersed several times in sugar solutions of increasing strength, permitting the tissue to absorb some of the sugar. Artificial cherry flavoring and usually a preservative such as benzoate of soda are added to the final syrup. The syrup, together with the colored cherries, is then heated to boiling and hot-filled into glass jars, which are capped hot. If cherries and juice are packed and sealed at or above 190°F., they usually do not undergo any spoilage until the container is opened. The addition of a preservative will make the product stable for use and storage after the container has been opened by the consumer. Properly packaged and sealed containers may be stored at room temperature. Refrigeration is desirable after opening and partial use of contents.

Toppings, whether frozen or in aerosol cans, vary considerably in composition. They may contain no dairy ingredients or a high percentage of dairy ingredients. Most of these are fabricated to resemble whipped cream when used. All contain some type of fat, which is usually dispersed by homogenization. Those packed in aerosol cans are virtually always pasteurized, and consequently require refrigeration. Some toppings are frozen and must be kept frozen until used.

Topping mixes are frequently made by mixing melted fat with gelatin solution and spray-drying the mixture. Flavoring agents, antioxidants, and emulsifiers are usually added. These mixes are packed in sealed pouches and stored at room temperature.

Canned puddings are basically made into complete puddings except for final cooking before canning. They are commercially sterilized by the newer aseptic method or by very careful control of processing details in older canning methods to prevent textural breakdown by overcooking. Process method controls are very critical to adequately sterilize the product without causing deterioration of the product resulting in browning.

Rennet desserts are generally similar to dry pudding mixes, except that gelatin depends on action of the rennin ingredients with the proteins of the milk with which it is prepared. Rennin, a natural enzyme from the meat-processing industry, is mixed with sweetening, flavoring, and coloring ingredients to which some natural gums are usually added to assist in the gelling process. The gelling of rennin and milk requires very careful temperature control. These rennet dessert mixes are packaged and stored as pudding mixes.

V. QUALITY CHARACTERISTICS

The gelatin desserts require sweet, mildly acid, and adequate fruit-type flavoring, with a color characteristic of the fruit represented by the flavor designation. Gelling is essential; the rate of gelling when chilled should be as fast as possible. The resultant gel must be adequately firm and resist melting at room temperature.

Puddings and pie-filling mixes are required to have a sweet taste, a pleasant flavor, and a smooth texture when prepared for consumption.

Dessert dry mixes do not constitute any health hazard provided that the instant (unheated) types are made under sanitary conditions to prevent introduction of salmonella bacteria.

Maraschino cherries require a customary brilliant red color as well as the sweet and pleasant imitation cherry flavors (usually benzaldehyde). Since they are primarily used as a colorful garnish, uniformity of size and freedom from blemishes and damage are essential. There are no health hazards associated with this product because it is normally packed hot and has preservatives to prevent mold when opened.

Toppings must be readily whippable and capable of retaining their foamed condition for several hours when prepared without showing syneresis (weeping). Since some have considerably more perishable ingredients than others, the industry usually pasteurizes these products. Consequently, there is no danger of the presence and propagation of pathogenic bacteria, provided that normal sanitary practices were used during processing and packaging.

Canned puddings have the same flavor and texture quality requirements as puddings made from mixes but require no home preparation.

Rennet desserts require critical control of exact amounts of ingredients to assure consistent setting of prepared desserts from each package.

VI. PROCESSING AND STORAGE QUALITY LOSS FACTORS

A. Identification of Potential Causes of Quality Losses

Lumping of gelatin dessert mixtures can be the result of excessive moisture remaining in the product after processing, the loss of moisture during package storage, storage at high summer temperature/humidity, or certain combinations of ingredients. Loss of flavor may result from the use of improper flavor mixing and setting methods during processing or from poor barrier materials for packaging. Overall quality retention is dependent on formulation and packaging materials and methods.

B. Food Industry Practices for Quality Maintenance

Use of heat-sealed packages (at increased materials cost) is being adopted to minimize loss of flavor during storage.

Pudding mixes are quite stable.

Pie-filling mixes may gradually lose setting power owing to slow action of the acid on the starch and other gelling agents.

Any of the mixes containing fats such as the whipped desserts are subject to oxidation and rancidity of the fats during storage. Use of antioxidants retards this type of fat spoilage.

Topping mixes, besides having a possible tendency to become stale, may show a gradual tendency to lose whipping power.

Canned puddings may turn brown and develop syneresis during long-term storage.

VII. PRESENT PRACTICES OF CODE DATING/PUBLIC DATING

A. Voluntary Food Industry Code Dating and Monitoring

Company #30FIS: This major retail chain manufacturer codes all its dessert products and monitors the age of products in its supermarkets. Sells out-of-date foods in special sales.

Company #630FIS: Codes all its individual products for day of the year, plant, batch, and product.

Company #560FIS: Codes its whip desserts by individual package with date of production, plant location, shift, and production line. Monitors and retrieves its products in field.

Company #530FIS: Codes gelatin dessert and pudding powder packages with date of production for stock rotation only. Rotates stock in its stores.

Company #165FIS: Codes the date of pack and plant location on each package. Sales representatives know code and check movement of stock in retail channels.

Company #470FIS: Codes all packages with date of production. Company has assigned shelf-life periods to all products, beginning with the date on which product is still good but at which time it requires personnel to report it as older stock on hand; on second date special sales action is required; if product is on hand by third date, it is to be picked up and destroyed.

Company #355FIS: Codes all packages with year, day of packaging, and plant location if packed in multiplant locations. Supplementary information such as month, shift, hour, packing line may be included.

B. Legal or Required Dating--(covers all product groups--A, B, C)

1. Federal--There are no Federal requirements for public dating. The FDA regulations contained in the Federal Register, April 26, 1969, Good Manufacturing Practices, indicate that FDA would like code dating in interstate and intrastate commerce shipments.

2. State and (3) Municipal--No requirements on dating located.

4. Foreign--See Legal Report, appendix II. Denmark requires that marmalade show week of production which may be in code.

C. How Dating Influences Quality Maintenance: Advantages and Disadvantages of Dating

Open dating will not assure the consumer of always getting top-quality products because storage stability and shelf life are dependent on choice of raw materials, manufacturing methods, package design and packaging materials, care exercised in quality control, storage and transportation environment, and possible abuse of product owing to long exposure to excessive or fluctuating temperatures.

Because many of these products have relatively long storage life, selection of a slightly later dated product by the consumer in preference to a slightly older package would not assure the customer of getting any better product. Quality changes are often so slight and subtle that they are virtually undetectable. This practice could lead to the rejection of good quality merchandise which would probably eventually have to be destroyed. In general, since the health hazard problems of these products are low, there is no need to openly date them with date of manufacture or date of expiry.

VIII. FOOD PRODUCT ITEM LIST

A. Shelf Life--Food Industry Source

<u>Food item</u>	<u>Time*</u>	<u>FIS No.</u>
Butterscotch topping	210D	520
Caramel topping	210D	520
Coating, bittersweet	9M	630
Coating, milk	12M	630

*Y = year, M = month, D = day.

<u>Food item</u>	<u>Time</u>	<u>FIS No.</u>
Coating, vanilla	12M	630
Fruit topping	360D	520
Gelatin desserts	8M	30
Gelatin desserts	No time, move quickly	530
Gelatin desserts	12M	355
Gelatin, plain	8M	30
Hot fudge	210D	520
Marshmallow cream	210D	520
Minced meat (glass)	24M	630
Pecan	210D	520
Pudding	8M	30
Pudding, canned	24M	165
Pudding, canned: chocolate	24M	470
Chocolate fudge	24M	470
Vanilla	24M	470
Butterscotch	24M	470
Lemon	18M	470
Pineapple	18M	470
Pudding, plum	18M	630
Pudding, ready-to-serve	6-8M	360
Strawberry	210D	520
Topping, flavored dry mix	2-3Y	560
Walnut	210D	520
Whip, aerosol (sterilized)	6M	560

<u>Food item</u>	<u>Time</u>	<u>FIS No.</u>
Whipped topping, frozen	Indefinite	719
Whipped topping, thawed and refrig.	6M	719
Whipped cream, dry mix	2-3Y Room temp.	560

B. Shelf Life--Scientific Sources

One professional source (8) advised that:

- (1) Gelatin desserts will easily keep for 1 year, except in the deep South where, because of high temperatures and humidity, they are likely to undergo lumping. Storage should not exceed one summer.
- (2) Of the puddings, the cooked type has better stability than the instant type, but both could generally be stored 1 year, except lemon pie filling which should not be held beyond one summer in the deep South.
- (3) Toppings in aerosol cans containing fresh cream and a propellant gas should not be held more than 30 days in the deep South, nor more than 60 days elsewhere, and always under refrigeration.
- (4) Canned puddings should not be stored longer than one summer because of possible browning and syneresis.

IX. RECOMMENDATIONS ON POSSIBLE MEANS OF FOOD QUALITY MAINTENANCE

A. Through Dating/Coding

Open dating of individual packages is not recommended (see section VII, subsection C).

The open dating in English of all shipping cases and overwraps is recommended to encourage rotation of stock.

Date of shelf display stamping on all packages is recommended to encourage stock rotation at retail stores as well as to provide the consumer with information on time since purchase.

B. Other Means of Quality Improvement

Packages of dry mixes for toppings should contain advice to the consumer to treat the finished topping which has been prepared for use as a perishable product which is to be kept refrigerated. Since formulations vary, individual manufacturers are best qualified to recommend a maximum time the consumer may hold the prepared product before discarding it. At least one manufacturer (#355FIS) places such a warning statement on his package.

The use of the instructional term "Do not store in a hot (over 70°F.) humid place" versus "Store in a cool dry place" is recommended.

X. REFERENCES

References for groups A, B, and C are included at the end of product group C.

(B) Spreads

This product group is divided into two categories--(1) peanut butter, and (2) jams, jellies, preserves, and marmalades. These are treated separately according to the report format.

(1) Peanut Butter

I. INTRODUCTORY REMARKS

Peanut butter is the only nut butter produced in sizable quantities in this country. It is not only used as a spread, but also as an ingredient in cakes, cookies, and confections, in which it is used both for its flavor and shortening value.

II. SUMMARY OF RECOMMENDATIONS

See section IX in this product category and section II in product group (A), Desserts and Toppings, above.

III. TYPE OF FOOD AND PRODUCT GROUPS

Spreads constituted 0.35 percent of supermarket sales in 1968, according to Chain Store Age (1). There are several product varieties, varying from finely ground, smooth products to those containing coarse pieces (usually referred to as "chunky"), for which no sales breakdown data were obtained.

IV. TYPE OF PROCESSING AND PRESERVATION

After roasting and removal of their shells, peanuts are ground to meet individual company requirements. Salt and sometimes sweeteners are added. Most peanut butters on the market now also contain a small portion of hydrogenated oil, which retards or prevents the separation of peanut oil from the butter on standing. Should the oil separate from the butter, it is subject to staling and rancidity.

Peanut butter may then be homogenized to disperse fine oil droplets throughout the peanut butter and help retard or prevent separation of the oil during storage. Coarse pieces of peanut chunks may be added to regularly processed peanut butter for additional textural quality.

Careful control of roasting is necessary to produce peanut butter that has good acceptability and durability, with medium roast being the most desirable according to Morris and Freeman (2).

Peanut butter is filled into jars and stored at room temperature. At present, there are no Federal Standards of Identity applicable to peanut butter. Standards have been issued by FDA but have been stayed pending judicial review (3).

Grade standards of peanut butter have been issued by the Consumer and Marketing Service, USDA, for voluntary use by industry, to aid processors, distributors, and retailers. The grades, known as Grade A (Fancy), Grade C (Standard), and Substandard, are based on color, consistency, absence of defects, and flavor and aroma.

V. QUALITY CHARACTERISTICS

Peanut butter is considered a nutritive spread because of its high fat, protein, mineral, and B-vitamin contents (4, 5). The characteristic flavor is an important quality factor. Texture, whether smooth or "chunky," is also a factor of consumer judgment, as is spreadability. Additionally, resistance to oil separation on the surface has become a generally accepted requirement.

VI. PROCESSING AND STORAGE QUALITY LOSS FACTORS

The absence of aflatoxin due to mold infections is a requirement. As discussed in the section under "Nuts," this toxin occurs in peanuts. Recent studies have been made to apply suitable preventive methods. One large manufacturer of peanut butter (#120FIS) determines by analytical methods that both the incoming peanuts and the outgoing peanut butter are free from aflatoxin.

Separation of oil to the surface may still be a problem. This can result in staling and rancidification of the oil, especially after the container has been opened. However, as mentioned earlier, this tendency has been greatly reduced by the addition of hydrogenated oil to the product.

Separation can be induced by storing the oil at higher than normal room temperature, i.e., above 75°F., for long periods of time. Company #120FIS stated that:

"...whereas peanut butter is desirably held in commercial storage at temperatures not in excess of 75°F. (#120FIS practice), it can withstand higher temperatures, such as 85° to 95°F. for days on end, without too significant a loss of organoleptic qualities..."

Industrial practices which include the above are used by company #120FIS. This company also analyzes its incoming peanuts microbiologically, and periodically tests its products during manufacture and storage for all the desired quality attributes.

The need to avoid high temperatures exists throughout the life of the product, whether in warehouse, distribution, sale, or consumer premises.

VII. PRESENT PRACTICES OF CODE DATING/PUBLIC DATING

A. Voluntary Food Industry Code Dating and Monitoring

Company #120FIS (a large manufacturer) reports that individual packages are coded to indicate month of production. Shipping cases are coded with day of production. Production inventory is regulated to keep up with sale and to avoid overproduction.

The sales force is instructed to monitor dates of product in retail outlets and arrange for return of outdated goods. The quality control staff from laboratories in different locations of the country check products in retail stores and examine them for quality losses. All out-of-date products are picked up, returned to plant for disposal; they are not resold.

Company #530FIS (a large retail chain selling products of its own manufacture or made by others under their private label) reports that individual packages are date-coded for stock rotation. The product is considered to have long-time stability and is expected to be sold before appearance of any significant deteriorations.

Company #30FIS code dates all packages.

B. Legal or Required Dating--See same section in product group (A), Desserts and Toppings, above.

C. How Dating Influences Quality Maintenance

Open dating will not assure the consumer of always getting top quality because adverse changes owing to mishandling, such as prolonged storage or transportation at too high a temperature (over 75°F.), careless processing, or purchase of old or low-grade peanuts to decrease costs, would not be regulated or controlled by dating.

VIII. SHELF LIFE--FOOD INDUSTRY SOURCES

<u>Food item</u>	<u>Time*</u>	<u>FIS No.</u>
Peanut butter	6M	120
Peanut butter	4½M	30

*M = month.

<u>Food item</u>	<u>Time</u>	<u>FIS No.</u>
Peanut butter	"M" Quality change virtually non- existent for ex- tended periods of time.	530

IX. RECOMMENDATIONS ON BEST MEANS OF FOOD QUALITY MAINTENANCE

Open dating of individual packages is not recommended because it would not assure the consumer of always getting the best quality nuts since product quality can be lowered by (1) subjecting it to too high a temperature, (2) use of poor-quality peanuts, or (3) defects in processing methods.

Open dating in English on all shipping cases and overwraps is recommended to encourage rotation of stock.

Date of shelf display stamping on all packages is recommended to encourage stock rotation at retail stores as well as on the consumer's premises.

The food industry should adopt coding of packages in accordance with FDA Good Manufacturing Practices, Federal Register, April 26, 1969.

Commercial storage of peanut butter should never be above 75°F. Peanut butter should never be stored in direct sunlight.

X. REFERENCES--References for groups A, B, and C are included at the end of product group C.

(2) Jams, Jellies, Preserves, and Marmalades

I. INTRODUCTORY REMARKS

These product categories accounted for 0.37 percent of total supermarket sales during 1968, according to Chain Store Age. These products, with the exception of marmalades, are defined by Standards of Identity which have been promulgated by the FDA under the Food, Drug, and Cosmetic Act. Since marmalades have no official FDA definition, all of their ingredients must be listed on the label..

II. SUMMARY OF RECOMMENDATIONS (see section IX below in this product category and section II in product group (A), Desserts and Toppings, above)

III. TYPE OF FOOD AND PRODUCT GROUPS (see also section III in product group (A), Desserts and Toppings, above)

These products have been made for many years, originally as home-made products. All are made from fruit and depend on pectins for their gel formation.

Jellies are clear because they are made with filtered or strained fruit juices or fruit juice ingredients. The juices of 27 fruits are permitted in standard jellies. The fruit juices may be used as 100 percent from a single source or in combinations up to five sources for a given jelly. Specified minimum ratios of juices to sugar are required. Finished jellies are required to contain at least 65 percent soluble solids which are composed of at least 45 parts of fruit juice or fruit juice ingredients to every 55 parts of sweetening agent. For practical manufacturing purposes, the minimum soluble solids content is usually maintained at 68 percent. Fruits and their juices normally contain pectin, but Federal standards permit the addition of sufficient pectin to compensate for deficiencies, since fruits differ from one another in their pectin content. Sweetening agents consist principally of sucrose, but may include invert sugar, dextrose, corn syrups (liquid or dried), or combinations of these. Other permitted ingredients are spices, acids (fruit juices and specified organic acids), buffer salts, such as sodium citrate, preservatives, such as sodium benzoate, cinnamon or certain other flavorings, coloring in certain specified jellies, such as apple, crabapple, and pineapple, and antifoaming agents, such as various edible oils and fats or mono- and diglycerides.

Preserves and jams are synonymous according to the Federal Standard of Identity. The requirements on composition of preserves are similar to those covering jellies. One principal difference is the use of fruit instead of fruit juices to yield products which are viscous or semisolid.

Artificially sweetened jellies and preserves are discussed under "Dietetic and Low-Calorie Foods."

Marmalades that have no Federal Standard of Identity require complete declaration of ingredients on the label. They are similar to preserves. In the case of orange marmalade, the skin and juice, after the pulp is discarded, are used in flavoring the final product.

IV. TYPE OF PROCESSING AND PRESERVATION

Fruits used for preparation of juices for making jelly are filtered or strained, with or without heating, prior to straining or filtering. After the pectin and the sweetening materials are added and solubilized, the batch is cooked to a given soluble solids content. Acid in the form of citrus juice or organic acids is usually added at the end of the process. Cooking is done by batch process in open kettles or in vacuum cookers. Continuous cooking processes are also in commercial use. Various procedural modifications can be made to suit the needs of each particular set of operating conditions, product, and equipment.

Jars are usually filled and capped hot. The caps are vacuum sealed because of the hot filling and capping. If the jars are filled at about 190°F., the product is usually commercially sterile, and will have satisfactory protection against spoilage. For preserves, the product may, in some operations, be cooled to 140-160°F. to increase the viscosity sufficiently to prevent the pieces of fruit from floating to the top of the containers.

Some operators subject the filled jars to a further "sterilizing" or "pasteurizing" process by first washing off any spillage and then running them through a hot water bath maintained at 180-190°F. for periods ranging from 15 to 30 minutes (6).

Gel formation is controlled by the dissolved solids content supplied by the sweeteners, by the acidity (pH), and by the pectin content.

Buffer salts, such as those permitted by the Federal standards, are used to control the rate of gelling to avoid partial setting before or during filling, resulting in unsatisfactory products.

Although these products are normally stored and displayed at ambient temperatures, several of the manufacturers have determined that higher temperatures accelerate color and flavor deterioration. One states that his products are stored at temperatures between 32 and 50°F. while they are in his possession.

V. QUALITY CHARACTERISTICS

Jellies and preserves are normally used for their organoleptic and aesthetic value instead of nourishment qualities. They are used as fillings in cakes and enhance the taste of bread and toast. They contain carbohydrates in the form of sugars.

Jellies require a smooth texture and a suitably weak gel strength to permit spreading, but need to be sufficiently rigid with no watery consistency. They are transparent, and have characteristic colors. Most fruits contribute an adequate amount of natural color to make them appealing. Artificial coloring may only be added to jellies made from apples, crab-apples, and pineapples, since these fruits have very pale colors and do not otherwise produce attractive looking jellies.

Preserves have somewhat the same requirements for acceptability, but usually do not have a rigid gel structure, or a requirement for sparkling clarity. They require a texture suitable for spreading without tendency to become watery, and require the visible presence of fruit pieces or whole fruits.

The combination of the relatively high soluble solids contents of 65 percent or higher and the natural acidity of the fruit, and the minimum acidity required to make effective gel structure (about pH=3.6) together

with usual hot filling of jars, results in a product which is not usually subject to bacteriological spoilage.

VI. PROCESSING AND STORAGE QUALITY LOSS FACTORS

Surface mold growth may occur if improper practices are used in filling the jars, but in modern operations of most large producers sufficient sanitary and operational practices are used to prevent the formation of mold prior to sale. Once the jar is opened, surface mold growth is possible. This may be avoided by refrigeration, replacing lids on containers, and avoiding the use of soiled utensils.

According to one producer (#960FIS), changes in color and flavor of jellies determine the end of shelf life; another producer (#630FIS) substantiates this observation.

VII. PRESENT PRACTICES OF CODE DATING/PUBLIC DATING

A. Voluntary Food Industry Code Dating and Monitoring

Company #530FIS codes production dates on most of these items for stock rotation. A few are considered more perishable and are dated to indicate time for removal from sale by company personnel if not yet sold.

Company #630FIS codes the production date by month, day, and year, as well as plant, batch, and product, by means of numerals and letters on the shipping case.

Company #960FIS uses a coding system, details of which were not revealed to the survey team.

B. Legal or Required Dating--Items 1-4, see same sections in product group (A), Desserts and Toppings, above.

C. How Dating Influences Quality Maintenance

Open dating does not influence quality maintenance because it does not influence handling practices. Open-case dating could help in stock rotation and assure the sale of most recently produced foods.

VIII. FOOD PRODUCT ITEM LIST

A. Shelf Life--Food Industry Sources

These periods are determined by various manufacturers and chain store operators and are used for stock rotation or general quality assurance. Generally they do not indicate termination of usability.

Company #530FIS codes preserves and jellies with production date for stock rotation only, with the exception of four preserves which are code-dated and scheduled with 5½ months of shelf life before removal from sale locations.

<u>Food item</u>	<u>Time*</u>	<u>FIS No.</u>
Blackberry preserves	8M	30
Black raspberry preserves	8M	30
Grape preserves	8M	30
Jam	6M	30
Jelly	15-24M	630
Jelly	6M	30
Marmalade	18M	630
Pineapple preserves	8M	30
Plum preserves	8M	30
Preserves	12M	630
Preserves	6M	30

*M = month.

IX. RECOMMENDATIONS ON POSSIBLE MEANS OF FOOD QUALITY MAINTENANCE

Producers generally state that product changes accelerate with higher storage temperatures, but no definite relationship seems to exist among storage temperature, time, and product degradation.

The following general recommendations applicable to other food product groups are recommended for jellies, preserves, and marmalades:

- (1) Open date of manufacturing on shipping cases
- (2) Code dating of all packages
- (3) Stamping of date of shelf display on each package
- (4) Application of FDA Good Manufacturing Practices on dating as proposed in the Federal Register, April 26, 1969.

In addition, consumers should be given instructions on labels to "Store in refrigerator after opening."

X. REFERENCES

References for product groups (A), (B), and (C) are included at the end of product group C.

(C) Syrup, Molasses, Honey

I. INTRODUCTORY REMARKS

All these product categories are sweet and are principally used in spreads. They are also used as ingredients in baked goods, cooked items, and confections by the homemaker. Besides being used for their sweetening value, some of them are used for their particular flavor, and some for their functional properties.

II. SUMMARY OF RECOMMENDATIONS (see section IX below of this product category, and section II in product group (A), Desserts and Toppings, above)

III. TYPE OF FOOD AND PRODUCT GROUPS (see section III in product group (A), Desserts and Toppings, above)

IV. TYPE OF PROCESSING AND PRESERVATION

Syrups, including corn and maple blends, are usually refined or partially refined syrups that are simply mechanically blended and then bottled at high temperatures (about 175°F.), and immediately capped and sealed. They usually have a density of about 67 to 75 percent soluble solids (degrees Brix). Because of this high sugar density and hot bottling, there is normally little if any likelihood of any microbiological deterioration occurring after packing and before opening of the container by the consumer. After opening, osmophilic yeasts may grow, but these are not hazardous.

The common corn syrup blends generally consist mainly of corn syrup, to which is added some form of flavoring or other ingredient such as molasses (refiner's syrup), cane sugar syrup, or artificial maple flavoring.

Syrups to which pure maple syrup is added may have somewhat less soluble solids in the finished product when bottled, especially if substantial amounts of the maple syrup itself are added, so sugar does not crystallize out of such styles of syrup during storage.

Molasses is produced from cane sugar during the normal process of sugar refining and production of white granulated sugar. It is the syrup remaining after crystallization of white sugar. Molasses is subject to a separate refining which is essentially a clarification by standardization of both color and flavor. This product, like the other syrups, is bottled hot, at about 75 percent soluble solids. All of the syrups discussed here are normally bottled hot and sealed immediately, which in addition to density, constitutes conditions of preservation. Storage is at room temperature.

Honey is deposited by bees in wax-celled combs, and reaches the market either in the form of comb honey, strained honey, "chunk" honey, or "creamed" honey, which is plastic. Strained liquid honey is the most common form reaching the market at present. The flavor of the honey is derived from the flowers from which the bees gather the nectar. According to the USDA Home and Garden Bulletin No. 37 (7), most honey on the market is either sweet clover, clover, or alfalfa honey. Honey is derived from many other flowers including those of the orange tree, buckwheat, and sage. Much of the honey sold is a blend of original types.

Strained honey is usually made by extracting the liquid from the wax combs by means of centrifuging. "Creamed" honey is made by evaporating off some of the water and then cooling and churning the liquid until crystallization takes place. "Chunk" honey is simply strained honey into which pieces of comb honey are put. Honey may be pasteurized before being packaged, and is stored at room temperature, preferably 70-80°F.

The Consumer and Marketing Service, USDA, has established Grade Standards for honey for voluntary use by the trade. The most important grade characteristic is flavor with respect to the predominant floral essence or blend. Also considered are absence of defects, as well as clarity. The grades for strained honey are U.S. Grade A (U.S. Fancy) or U.S. Grade B (U.S. Choice). Comb honey is graded as U.S. Fancy or U.S. 1.

Maple syrup is made by boiling and evaporating much of the water from the sap of certain varieties of maple trees. It requires about 40 gallons of sap boiled down to make 1 gallon of finished syrup. The syrup is boiled until it contains about 67 percent soluble solids (degrees Brix), after which it is filtered and then packaged hot (about 175°F.). Maple syrup is stored at room temperature. The sweetening agent in maple syrup is practically all "sucrose," which is chemically identical to white cane sugar.

Grade standards of maple syrup have been issued by the Consumer and Marketing Service, USDA, for voluntary use of the trade. Color is the principal grade requirement. The USDA grades are: AA = light amber, A = medium amber, and B = dark amber.

There are some fruit-flavored syrups produced, but these now constitute only a small part of the total syrup production. They are basically similar to corn or sugar-type syrups to which is added natural fruit extracts or artificial fruit flavors or both, with or without added color.

V. QUALITY CHARACTERISTICS

All the products included under syrups have sugars (carbohydrate) as the predominant and almost exclusive nutritional ingredient. Some products such as molasses also contain significant amounts of minerals. Sweetening power is the most important quality required of all of these products.

Sufficient viscosity is also a general requirement because most of these products are used as spreads on hot pancakes and waffles. The characteristic flavor of molasses is a desirable quality. It must be pleasant and prominent but not pungent, bitter, or otherwise unpleasant.

Honey has a flavor which is characteristic of the type of floral origin, and must not deviate significantly from the accepted standard. Some varieties such as orange blossom honey are relatively fragrant and mild, whereas others such as wild thyme honey are relatively pungent.

VI. PROCESSING AND STORAGE QUALITY LOSS FACTORS

Properly processed syrups and related products generally suffer few if any losses in quality while in the original sealed containers. Honey may darken slowly and become stronger in flavor after many months of storage, but will still be usable. If strained honey is stored at refrigerator temperature for extended periods, harmless crystallization may take place. This can be overcome by immersing the container in warm water to remelt the crystals.

Large producers of syrup practice quality control during processing and packaging.

Principal quality losses during warehousing and distribution may result from prolonged storage at elevated temperatures (over 85°F.) or refrigerated storage.

After the container has been opened by the consumer, yeast or mold growth may take place in a number of these products, but far less common, though possible, is the fermentation of syrups. Partially used bottles of syrup may develop watery layers on the inside bottle surface above the liquid layer because of changes in temperature which may ultimately result in mold growth. Honey may crystallize if kept in the refrigerator or in similarly cool storage. Honey also loses flavor if the container is left open. "Creamed" honey may become partly liquified if stored at too high a temperature.

VII. PRESENT PRACTICES OF CODE DATING/PUBLIC DATING

A. Voluntary Food Industry Code Dating and Monitoring

Company #120FIS codes the labels on all containers of syrup to show plant, shift, and day, month, and year of production. Shipping cases are stenciled in code form. This company has no specific monitoring and pickup

procedure because the storage life of its syrups is indefinite. It ships all of its products from 10 or 12 major distribution centers. These products are permitted 2-4 months storage in these warehouses. Older products are not shipped.

Company #530FIS codes all containers of its syrup for stock rotation purposes.

Company #30FIS codes all containers of its syrup and honey.

B. Legal or Required Dating--items 1-4, see same sections in product group (A), Desserts and Toppings, above.

C. How Dating Influences Quality Maintenance: Advantages and Disadvantages of Dating

Dating of these products would not assure the consumer of receiving good quality products because choice of raw products, processing methods, and care exercised in quality control influence the relative quality of the products. Deterioration is more likely to result from abuses during transportation and storage, either in warehousing, retail sales, or in the home. Because of the relatively long storage life of these products, the consumer would not be assured of getting any better product by choosing one of a more recent production than one of an older date.

VIII. SHELF LIFE--FOOD INDUSTRY SOURCES

Company #120FIS uses 2 to 4 months warehouse storage, depending on products; after that, retail shelf life is indefinite. It has found isolated containers of its products to be acceptable for 10 years. It has arbitrarily set 2 years for its chocolate flavored beverage.

<u>Food item</u>	<u>Time*</u>	<u>FIS No.</u>
Fudge syrup	12M	630
Honey	6M	30
Syrup	1+Y	815
Syrup	2Y	560
Syrup	9M	30
Syrup	12M	630
Syrup	Indefinite shelf life for extended time periods	530

*Y = year, M = month.

IX. RECOMMENDATIONS ON BEST MEANS OF FOOD QUALITY MAINTENANCE

A. Through Dating/Coding

Open dating of individual packages is not recommended (see section VII, subsection C).

Open dating, in English, of all shipping cases and overwraps is recommended to encourage rotation of stock.

Date of shelf display stamping on all packages is recommended to encourage stock rotation at retail stores as well as at consumer's premises.

B. Other Means of Quality Improvement

Commercial storage of these products, especially honey, is best at 70-80°F.

It may be beneficial to the consumer to be given instructions that partly used containers of syrup should be recapped, inverted once to wet the side and cap of the container with syrup, and restored to its normal position for storage to minimize a tendency for mold to develop. Consumers should also be given instructions that there is no need to refrigerate the product.

Opened containers of honey should be reclosed for storage to minimize loss of flavor.

Comb honey and strained honey are best stored at 70-80°F. "Creamed" honey may be kept at room temperature, but is best in the refrigerator if the temperature of the storage area is likely to rise to about 80°F. for any extended time.

X. REFERENCES

- (1) Chain Store Age, 1969 Supermarket Sales Manual, Lebhar-Friedman, Inc., New York, N.Y., July 1969.
- (2) Morris, N. J., and Freeman, A. F., Peanut Butter, VI, "The Effect of Roasting on the Palatability of Peanut Butter," Food Technology, August 1954, pp. 377-380.
- (3) Federal Register, issue of November 7, 1968.
- (4) Kilgore, Lois T., "How to Avoid Confusion in Fats and Oils Buying or Use," in Food for Us All, The Yearbook of Agriculture 1969, U.S. Department of Agriculture, 1969, pp. 226-231.
- (5) U.S. Department of Agriculture, Agricultural Research Service, Agricultural Handbook No. 8, Washington, D.C.

- (6) Sunkist Growers, Inc., Preserves Handbook, 7th ed., 1964.
- (7) U.S. Department of Agriculture, Agricultural Research Service, Honey, Some Ways to Use It, Home and Garden Bulletin No. 37, Washington, D.C.
- (8) Dr. N. D. Pintauro, Extension Specialist, Department of Food Science, Rutgers University, New Brunswick, N.J., personal communication.

XI. REPORT REVIEW AND COMMENTS

FIS #120 stated in relation to (B) Spreads, (1) Peanut Butter:

"In the first place, I agree completely with the conclusion drawn that a code marking giving the date of manufacture, as practiced by the food industry today, is adequate for all practical purposes. It is not in the consumers' interests to date, by an understandable calendar system, the day of manufacture....

"Secondly, I can endorse your position that shipping cases be dated by some understandable calendar system. As I had pointed out to you, we freely decipher our code to warehouse supervisors and the like to allow them to move stock properly, first-in becomes first-out.

"However, I cannot subscribe to your third recommendation, calling for a date to be stamped on the package of a food product as it is placed on the shelf of the retail grocery store. This serves no useful purpose and can, indeed, be misleading. The consumer will consider this date in relation to others, as an index of relative freshness. You can urge her as much as you like to compare such dates within only a given brand, but you know that the comparisons will go across brand lines. Distress but wholesome merchandise representing products that may have been held too long in warehouses awaiting shipping orders, or newly introduced products which fail to move as rapidly as predicted (and there are many such episodes) would be dated when they finally (at long last) reach the shelf as though they were fresh merchandise. This will compound the so-called problem you are trying to control. The housewife knows from experience which brands are freshest, made regularly with exacting controls, and will purchase such merchandise if she is quality conscious. If she is economically minded, she will buy on price, knowing full well that the quality may not be the best. No dating of product at time of shelf display will do anything more than confuse her. Hence, I would urge you and your associates to delete this recommendation from your report. Indeed, while your study does a fine job of explaining specific manufacturer practices, there is very little (if any) analytical foundation to support your recommendation for date of shelf display labeling...."

CANDY AND GUM

I. INTRODUCTORY REMARKS

Candy and gum are included in the survey although they are not foods in the general sense. They provide nutrients when their ingredients consist of nonfat dry milk solids, nuts, fruits, egg solids, and gelatin, but are usually consumed for pleasure. They constituted 1.3 percent of total supermarket sales in 1968, and were responsible for greater than \$700 million annual sales in supermarket outlets, which is estimated as only 35 percent of the total market.

Candy and gum products will be treated together except in sections IV, V, VI, and VII, where they will be treated separately.

II. SUMMARY OF RECOMMENDATIONS (see also Section IX)

A. Adoption by the New Jersey Department of Health of the coding recommendations of the FDA Good Manufacturing Practices, Federal Register, April 26, 1969, for processed foods. Disclosure of code meanings by food manufacturers to the New Jersey Department of Health on request by the latter.

B. Adoption of the open date of manufacture labeling for all outer cases/overwraps, etc., to assist in stock rotation.

C. Voluntary coding of all individual containers in such cases/overwraps by the food industry with codes of its own choosing (similar in intent to A above). Such codes should indicate plant location, date of manufacture of final product in container, shift, production line, and any other aspects of products, at the manufacturer's discretion.

D. No stamping of date of shelf display by retail stores for stock rotation and as a consumer aid in home storage stock rotation for candy or gum, except in the case of seasonal candy goods (i.e., Christmas, Valentine's Day, etc.)

III. TYPE OF FOOD AND PRODUCT GROUPS

Candy and Gum, by product group, category, and variety

Product group	Percent- age of total sales	Product cate- gory	Percent- age of cate- gory sales	Percent- age of total sales	Product variety	Percent- age of depart- ment sales	Percent- age of total sales
Candy	1.172	Bar candies	24.1	.313	Chocolate		
					multi-pack	2.1	.027
					Other, multi-pack	8.9	.116
					Chocolate, single	2.4	.031
					Other, single	5.3	.069
					Large sizes	5.4	.070
						<u>24.1</u>	<u>.313</u>
		Hard candies	11.4	.149	Roll candies, sour	.9	.012
					Roll candies, all other	3.6	.047
					Lollipops	2.7	.035
					All other hard candies, sour	1.2	.016
					All other hard candies	3.0	.039
						<u>11.4</u>	<u>.149</u>
		Chocolate coated candies	10.6	.138	Mints	2.9	.038
					All other	7.7	.100
						<u>10.6</u>	<u>.138</u>
		Chocolates, plain & coated	9.6	.124	Boxed (1 lb. and over	1.8	.023
					All other	7.8	.101
						<u>9.6</u>	<u>.124</u>
		Peanut candies	6.2	.080			
		Caramels, taffy and molasses	5.4	.070			
		Candy mints	3.9	.050			
		Jellies	3.8	.049			

Source: Chain Store Age, 1969 Supermarket Sales Manual (1), Lebhar-Friedman, Inc., New York, N.Y., July 1969. Used with permission of publisher.

Product group	Percent- age of total sales	Product cate- gory	Percent- age of cate- gory sales	Percent- age of total sales	Product variety	Percent- age of depart- ment sales	Percent- age of total sales
		Marsh- mallows	3.5	.046			
		Holiday specials	3.0	.039			
		Popcorn candies	2.6	.034			
		Licorice	2.1	.027			
		All other candies	4.1	<u>.053</u>			
				1.172			
Gum	.126	Single pack	5.1	.066			
		Multi- pack	4.6	<u>.060</u>			
				.126			
			<u>100.0</u>	<u>1.298</u>			

Candy Products

IV. TYPE OF PROCESSING AND PRESERVATION

The various basic types of candy are described below. They are usually made into the various modified forms, either singly or in combinations. These are then either used uncoated or are coated by one of about four general types of coating materials and techniques.

There may be a very wide divergence in the kinds of ingredients, which materially affects stability of the final product. First, the candy center portions themselves differ considerably from one another in their storage stability. Second, the basic types of candy are partly affected by the form in which they are handled, i.e., whether they are "cast" deposited in a mold (usually in starch impressions) or are cut from slabs. Third, when a coating is used, it usually protects the original candy from deterioration. But the coatings also differ considerably from one another in their ability to protect the candy center. Some coating materials, while protecting the center, add new but different forms of instability to the candy as a whole. Thus, there is a wide assortment of combinations of degrees of instability possible.

The diversity of candy products is so great that the only generalization that can be made about product composition is that sugar is a main constituent. The exception to this is that of nonsugar sweeteners used in "dietetic" or sugar-free candies, which are not discussed here.

Ingredients besides sugar also include corn syrups, molasses, honey, starch, sorbitol, malt extract, acids (citric, tartaric, malic, and others), milk, cream, whey and vegetable fat, nuts, fruits, cocoa, chocolate, gums (arabic, tragacanth, caragheena, and algin), gelatin, pectin, agar, coconut, egg white, soya derivatives, salt, licorice, emulsifiers, antioxidants, dextrose, and maltodextrin.

Processing is equally varied. Generally, some form of heating of the sugar solution is used to cause crystallization. This is followed by cooling, product shaping, enrobing, and packaging.

Soft Cream Candies

Soft creams in many forms constitute a large portion of candy. They are made by causing a rapid crystallization of sugar at 110°F., a relatively low temperature, to produce exceedingly small, smooth crystals. These are generally "enrobed" or "dipped" in coatings, including sweet, bittersweet, and milk chocolate, icings, and crystallized sugar coating. These fat-type coatings protect the centers against moisture gains for many months, provided reasonably low temperatures of 70°F. or lower are maintained. The end of shelf life of creams, other than through loss of moisture, may be caused by development of rancidity of coating fats. Antioxidants are used to retard this deterioration.

Candy Bars

Many candies, especially bars, contain an assembly of two or more basic types of candy. For instance, a core of nougat may be enveloped by a layer of soft caramel in which nut meats are embedded. Such a bar may be without any further coating and simply wrapped, or it may be coated with sweet chocolate, milk chocolate, or some modified coating. Regardless of the keeping quality of the various components, the stability of the outermost one usually dictates the overall keeping quality, provided the osmotic pressure is low.

Chocolate Bars

Solid chocolate, chocolate-coated items, and the well known bars of sweet chocolate and milk chocolate contain essentially those ingredients permitted by Federal regulation. Their keeping quality is chiefly dependent on surrounding temperatures. Principal ingredients are chocolate liquor (bitter chocolate), sugar, dextrose and dry corn syrup solids, cocoa butters for sweet chocolate, and the addition of some form of milk or milk product for milk chocolate. Modifications include the addition of nuts and cereal products. Bars are made by pouring melted tempered chocolate into metal molds and cooling under controlled conditions of temperature and relative humidity.

Chocolate-coated items, whether they be individually merchandised pieces, such as bars, or the conventional assorted chocolates, require the same conditions for preparation of the coating, its application, hardening, and storage as do bars of solid chocolate.

Before depositing into molds and especially before enrobing candy centers, chocolate coating is normally "tempered." Although techniques vary from plant to plant, chocolate used for enrobing may be at 85-92°F. After depositing or enrobing, chocolate bars or chocolate-coated pieces are chilled by a counter-current of cold air, entering at about 40°F.

V. QUALITY CHARACTERISTICS and VI. PROCESSING AND STORAGE QUALITY LOSS FACTORS

A. Product Deterioration

Although the composition and characteristics of products known as "candy" vary greatly, no health hazards generally result from their storage because in most instances the moisture content is sufficiently low to prevent the growth of all bacteria, including pathogenic types. In some instances, this resistance to bacteriological spoilage is increased by the lower pH (or greater acidity) of some products resulting from the inclusion of fruits or of permitted organic acids in formulations. This does not eliminate the possible health hazard that might be present in a confection owing to the presence of some toxin or bacterial infection which may have been accidentally introduced during processing or packaging. However, assuming that such an infection were accidentally present, its presence would not be due to nor increased during storage, nor would its presence be revealed by any coding or dating system.

Rancidity could develop in some products during storage, especially in products containing nuts. Certain fats and oils may develop rancidity, but the probability of such occurrence is low. Rancidity can be retarded by use of FDA-approved antioxidants and also by storing in refrigeration or frozen conditions, provided that the product is compatible with low-temperature storage.

Moisture loss is one of the changes causing loss of quality. Drying out, which causes textural changes, appears in different ways in different products. For instance, it will cause objectionable toughening of chewy products, or brittleness of tender products. Generalizations cannot be made about retarding moisture loss, but it can be minimized by suitable packaging materials, which act as moisture vapor barriers. Freezing also helps to stabilize moisture loss.

Development of insect life may take place during storage. This may result from infestation of nuts or certain fruits which did not receive sufficient processing heat during manufacture. Many nut meats do not receive any heat treatment during normal processing. Refrigerated or freezer storage of raw nut meats will arrest insect development (see chapter on nuts). This

may be practical during warehouse storage, but is often not part of sales display storage.

Insects may also enter a package while in storage in wholesale or retail channels, especially if the package is not properly sealed. Obviously, prolonged storage life would permit propagation of these insects within a package. However, neither a manufacturing/package date nor an expiration date would control the situation, because it would have no relationship to the inception of the infestation.

Chocolate "bloom," the gray appearance sometimes found on chocolate-covered candies or on chocolate bars, has no relationship to product age, but is usually caused by product exposure to long high temperatures. Chocolate products continually stored at 65°F and 65 percent relative humidity will normally not develop this bloom at any age. However, chocolate can readily acquire it within minutes of exposure to summer temperatures of 95°F. This type of bloom is caused by low-melting fractions of the cocoa butter actually melting, coming to the surface, and then congealing in the characteristic gray form on recooling. Another type of bloom can be caused by bringing chilled products into a much warmer, humid place, causing condensation of moisture on the surface. This results in traces of sugar dissolving from the coating and recrystallizing when the surfaces dry out.

Stickiness, and later graininess, may develop in hard candies because of absorption of moisture from the air. While both changes may occur with time, they are relatively unpredictable and depend on a combination of factors, including moisture permeability of the package, relative humidity around the candy, prevailing temperatures, formulations, and manufacturing techniques.

B. General Storage Practices for Quality Maintenance

Because of the diversity of product characteristics, there is no universal set of storage conditions applicable to all types. However, some form of low-temperature storage will prolong shelf life of virtually all candies. ASHRAE states that storage at 68°F. and 50 percent relative humidity will be adequate for storage of all candies (2). The lower the storage temperature, the longer the shelf life of candies in general, but the greater will be the hazard of harmful effects of moisture condensation on removal from refrigeration. Control of relative humidity of air in contact with candy is usually more significant than control of temperature. Thus, many candies may be sold under summer temperatures without significant harm. Nevertheless, chocolate-coated products are readily affected by even short exposure to high temperature. For example, chocolate products exposed to sunshine for only minutes are likely to show bloom, or graying, after this exposure. Storage of chocolate products at 85-95°F. for a few hours is also likely to produce bloom.

The shelf life of each type of candy is governed by the stability of its own ingredients. During sales display, candies are usually not refrigerated, with the exception of chocolate-coated products in summer time in some locations. Some of the general benefits of refrigerated storage are:

- (1) Loss of flavor, aroma, and color is less likely to occur.
- (2) Candies remain firm and show less tendency to become misshapen, resulting in sticking together or sticking to wrappers.
- (3) Insect life is arrested below 48°F.
- (4) Rancidity is reduced, but there is a tendency for the candy to become stale.

According to ASHRAE, most candies stored at 48-50°F. remain good for well over 4 months; but those containing nuts, butter, and cream are likely to become stale or rancid in 4 months or less, even at that temperature (2). A similar condition prevails at 32-34°F. storage, with the less perishable types remaining salable for 1 year or more.

The storage life of most candies is significantly increased by frozen storage at 0°F., but generalizations cannot be made because the following factors must be considered:

- (1) Economic justification, i.e., manufacturing, distribution, and retail practices
- (2) Reformulating certain products which crack objectionably during freezer storage
- (3) Moisture-proof packages for frozen products, mainly to prevent dessication of the product with resultant graining, hardening, and loss of flavor.

In response to the survey of industry sources, one company (#140FIS) replied as follows:

- "1. ...to protect the various types of candies, we attempt to construct a package which will be best suited for each specific candy.

...to check our candy in the package we run a storage test at 95 degrees F. and 72 percent relative humidity for 10 days. The candies that will withstand these conditions in general will withstand the variations encountered when shipped to various parts of the country. Chocolate will not withstand these conditions and must be shipped in refrigerated trucks during the summer season.

We use sensory methods for determining the condition of our candies in our storage tests, that is appearance, flavor and texture.

...Hard candies require low humidity, otherwise they become sticky; gum and caramel candies require a higher humidity in

order to keep them from drying out; and chocolate candies are very critical at or above temperatures of the melting point of cocoa butter.

- "2. (a) Storage conditions affect the color, flavor, and texture.
- (b) Changes in nutritive value are not a problem.
- (c) Changes in microbial deterioration are not a problem because of the low moisture in our products. Changes in flavor, such as development of rancidity or loss of flavor are problems.
- (d) Insect infestation is a problem with nut candies and chocolates.
- (e) Phase separation or reconstitution are not problems.

"Because of the variability of our products we use different storage conditions for various types of candies. The following are the storage conditions, with storage age, used for our candies:

45°F. & 50% R.H. - Chocolate & Nut candies; 3 - 6 months storage age.

60°F. & 50% R.H. - Gums, Fudge, Caramel, Toffees, Nougats, Marshmallow; 2 - 8 month storage age.

75°F. & 35% R.H. - Hard candies; 3 - 6 month storage age."

Another food industry source (#315FIS) replied:

"Our chocolate products are ideally stored at temperatures of about 65°F. or below, but can be stored for several weeks at temperatures as high as 78°F. without any noticeable change. Extreme temperatures, as far as chocolates are concerned, would be those in excess of 78°F. Generally, exposure to temperatures of 90°F. or above for periods of several hours and then sudden exposure to cooler temperatures--such as air conditioning or refrigeration--is also a cause of deterioration."

Company 630FIS stated:

"Chocolate products are stored under refrigeration at a 65°F. minimum and 70°F. maximum temperature. A maximum relative humidity of 50 % must be maintained.

Another source (#600FIS) reported:

"Aging of our products causes some desirable and later undesirable changes. However, the changes that the product undergoes are not those that would be considered a public health hazard. Fresh products usually have a characteristic texture and flavor and a short aging period allows for a more desirable texture (e.g., softer nougat) and a mellowing of the flavor. Excessive aging could lead to undesirable flavor, e.g., oxidation, rancidity, and/or staling, from the breakdown of the product components."

VII. PRESENT PRACTICES OF CODE DATING/PUBLIC DATING

A. Voluntary Food Industry Code Dating and Monitoring

No specific systems were outlined, but coding is used by some companies.

B. Legal or Required Dating

1. Federal--There are no Federal requirements for public dating. The FDA regulations contained in the Federal Register, April 26, 1969, Good Manufacturing Practices, indicate that FDA would like code dating in interstate and intrastate commerce shipments.

2. State and (3) Municipal--No requirements were noted.

4. Foreign--No particular requirements were noted (see Legal Report, appendix II).

C. How Dating Influences Quality Maintenance: Advantages and Disadvantages of Dating

As stated before, dating would not influence the quality of these products. They are rapid turnover items, and dating for the public would be of dubious significance. Dating of cases and overwraps for the purposes of stock rotation in channels of distribution and at the store level, and date of shelf display would assure a methodology for correct shelf stocking in supermarket, retail, and vending outlets.

Sections VIII, IX, and X are included in the discussion of "Gum" below.

Chewing Gum Products

IV. TYPE OF PROCESSING AND PRESERVATION

Chewing gum is a comparatively simple product, compared with other confections, but requires intricate machinery for manufacturing and wrapping. Natural rubber latexes (chicle) were used for the gum base, but are now generally replaced by synthetic materials such as polyvinyl acetate. The use of this material is approved by FDA.

The common ingredients of chewing gum include the gum base, whether natural or synthetic, a sweetening agent such as sugar, dextrose, or corn syrup flavoring, and water. Other modifying ingredients may be added, particularly certain oils which hold the flavoring materials.

Normally, no cooking is involved. Besides preparation of the gum bases, other ingredients are added and the entire mixture kneaded. The complete mixture is then accurately rolled to a specific thickness, coated with a fine film of sweetening agent to minimize sticking, cut to a prescribed size, dried, and wrapped.

V. QUALITY CHARACTERISTICS

The shelf life of chewing gum may be limited by the product drying out, or by volatilization or oxidation of flavors.

Normally, little attention is paid to specific storage conditions for chewing gum. However, a temperature greater than 85°F. and 50 percent relative humidity may result in sweating and loss of flavor by volatilization, causing stickiness and wetting of the wrapper. Refrigerator temperatures may make the gum too brittle for immediate use, but will not permanently harm it.

The foregoing applies to stick-type chewing gum. The small candy-coated pieces are coated with a hard casing. In this type, the gum portion is considerably better protected, especially against drying out, than is the stick form.

Since specific storage conditions are not prescribed for storage and sale conditions of chewing gum, but storage at high temperatures can accelerate drying and leaking out of the flavor oils, there is not necessarily a relationship between age and palatability.

Other than the loss of the aforementioned textural or appearance qualities during storage, no other objectionable conditions are likely to occur. Because of the very low moisture content--about 2 percent of the gum portion--there is no danger of microbial growth which may result in a health hazard.

Since, except for the small caloric content in the sweeteners, the nutrient quality of chewing gum is virtually zero, and chewing gum is not chewed for any nutritional value, there can be no nutritional loss during storage. There are no deteriorative processes caused by enzyme or chemical action which take place during storage.

VI. PROCESSING AND STORAGE QUALITY LOSS FACTORS

See section V above.

VII. PRESENT PRACTICES OF CODE DATING/PUBLIC DATING

A. Voluntary Food Industry Code Dating and Monitoring

A major manufacturer (#10FIS) of chewing gum products provided the following information:

"1. General

The age of a finished product is determined by the date of manufacture and is recorded by printing or embossing the day, the month and/or the year of manufacture on display boxes, sleeves, display box wrappers, cellophane wrappers, shipping containers and/or the package itself. Combinations of the day, month, or year may also be used.

The day, month, and year of manufacture is defined as the day, month, and year in which the product is initially wrapped or packaged.

If not otherwise required by...the Corporation, only the month and year of manufacture, plant location letters, and brand variation letters are used on display boxes, box wrappers, sleeves and shipping containers.

The month and year of manufacture are transposed to a date of expiration for all products on all shipping containers."

"2. Code Dating of Shipping Containers

Shipping containers for...gum...and other brands that have a daily manufacturing date shall be imprinted with the same date code as used on the individual packages on the address panel only. In addition, the regular expiration dating shall be imprinted on the containers... If two or more daily dates are packed in a shipping container, then all the necessary daily dates will appear on the shipping container on the address panel."

"3. Dating and Coding of Display Boxes, Box Wrappers, Throw-Away Sleeves, Boxes and Covers

...When throw-away sleeves, boxes, covers or overwraps are used, they shall be stamped with the plant location, month, and year symbols only if the information on the box wrapper or the display box is not visible after the throw-aways are in place. The date on boxes or sleeves to be wax wrapped shall be legible through the wax wrapping."

"4. Dating of Shipping Containers

Shipping containers should be dated with the expiration date of the goods packed in the container. In addition, if the goods are a lettered variation of a brand, the identifying letter shall be added as a suffix."

"5. (a) Age of Products Shipped

At all shipping locations, the first in-first out rule shall apply. If possible, the oldest stock should be shipped to the nearest warehouse or to an area with a high volume of sales. The stock with the most recent dates, i.e., longest expiration date, should be shipped the greatest distance.

(b) JOBBER AND RETAILERS

(1) Age Limit

This is determined for the salesman by the date of manufacture on the package, the display box or the expiration date on the shipping container...

(2) Warning System

Salesmen are required to remove from the jobbers and chain store warehouses all products which have four months or less shelf life remaining and to place them in outlets with a large volume of sales. This procedure should allow the products to be sold at the retail level before expiration of their age limits.

"6. Dating--Miscellaneous

- a. When returned goods are repacked and placed in stock, the original expiration date shall be stamped on the shipping container unless otherwise specified.
- b. Normally, goods of different manufacture dates and age limits are not packed in the same shipping container. If this must be done the expiration date of oldest stock and/or the brand with the shortest age limit packed shall be stamped on the shipping container."

B. Legal or Required Dating

1. Federal--There are no Federal requirements for public dating. The FDA regulations contained in the Federal Register, April 26, 1969, Good Manufacturing Practices, indicate that FDA would like code dating in interstate and intrastate commerce shipments.

In the case of chewing gum, this product may be considered in a "medical" area and as such requires FDA coding (see item 2 above in #10FIS information).

2. State, (3) Municipal, and (4) Foreign--No specific requirements were noted.

C. How Dating Influences Quality Maintenance: Advantages and Disadvantages of Dating

Public dating would not be of any great benefit from the point of view of general quality and health. Nutritional quality losses do not seem significant in this product. The recommendations of the survey team on the advantages of industrial coding, with respect to case dating (#10FIS uses coding) of overwraps, cartons, etc., and product coding are in practice by at least one member of the industry (#10FIS) on a voluntary basis. (See section VII A, 1-4 above.)

VIII. FOOD PRODUCT ITEM LIST

A. Shelf Life--Food Industry Sources (FIS)

Candy and Gum

<u>Food item</u>	<u>Time*</u>	<u>FIS No.</u>
Candy	16W	600
Candy	9M	315
Candy	--	960
Candy	17W	30
Candy, bar goods	9-12M	630
Candy, butterscotch	9M	630
Candy, caramels	2-8M	140
Candy, caramel nut	10W	30
Candy, caramel nougat	13W	30
Candy, cherries	13W	30
Candy, chocolate	6M	30
Candy, chocolate nut	10W	30
Candy, chocolate nut	3-6M	140

*M = month, W = week.

<u>Food item</u>	<u>Time</u>	<u>FIS No.</u>
Candy, chocolate coated nut	10W	30
Candy, chocolate mint cream	13W	30
Candy, chocolate morsels	9M	630
Candy, chocolate wafer	13W	30
Candy corn	15W	30
Candy, fudge	2-8M	140
Candy, hard	3-6M	140
Candy, hard	13W	30
Candy, licorice	13-15W	30
Candy, mints	13W	30
Candy, mints	6W	630
Candy, molasses	13W	30
Candy, nougats	2-8M	140
Candy, peanut butter	9W	30
Candy, peppermint	9W	30
Candy, salt water taffy	9W	30
Candy, toffee	13W	30
Candy, toffee	2-8M	140
Marshmallows	2-8M	140
Marshmallows	7W	30
Popsicles	20W	580
Gum	13W	30
Gum	2-8M	140
Gum, nougats	9W	30

IX. RECOMMENDATIONS ON BEST MEANS OF FOOD QUALITY MAINTENANCE

Whereas candies and gum used to be sold predominantly by drug stores and candy-newspaper stores, the volume has shifted very significantly to super-market outlets and vending machines. Confectionary stores exist and are major outlets for large candy box sizes. Consumer loyalty and luxury pricing in these stores require dehumidified and cooled-store conditions and rapid turnover for maintaining a reputation for fresh, attractive products. The products in these outlets do not need public coding or dating.

Products sold via vending machines and supermarkets do not linger in machines or on shelves. Once purchased, they are consumed almost immediately. Accordingly, not much of a case can be made for consumer protection by special coding. Case dating is recommended for the convenience of retailers in inventory control. Where multiple units or packs are offered, the price stamp with date of display would be useful but not essential. Certain seasonal goods could benefit from dating practices (Halloween, Valentine's Day, Christmas, Easter, etc.) to assure movement within the season of manufacture.

Provision of candy storage instructions with respect to temperature (and possibly relative humidity) and their enforcement would assist quality maintenance. The establishment of microbiological specifications for ingredients is another area of consideration.

X. REFERENCES

- (1) Chain Store Age, 1969 Supermarket Sales Manual, Lebhar-Friedman, Inc., New York, N.Y., July 1969.
- (2) American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc., ASHRAE Guide and Data Book, Applications for 1966 and 1967, New York, N.Y.

Chapter 14

SUGAR

I. INTRODUCTORY REMARKS

Sugar constitutes 0.76 percent of total supermarket sales. Except for the brown sugars and certain powdered sugars, it is over 99.0 percent chemically pure sucrose. It is produced from either sugarcane or sugarbeets. The source of the sugar is determined by one or more economic factors, including basic cost of production and nearness of the growing source to refineries and consumer outlets.

Sugarcane is grown in tropical and subtropical climates, including such areas as Louisiana, Florida, Puerto Rico, Santo Domingo, and Haiti. Sugarbeets are grown in colder climates, such as the northwestern part of the United States.

While sugar can also be obtained from maple sap, this is not an economical source. Sucrose is chemically identical regardless of source.

II. SUMMARY OF RECOMMENDATIONS (see also section IX)

A. Adoption by the New Jersey Department of Health of the coding recommendations of the FDA Good Manufacturing Practices, Federal Register, April 26, 1969, for processed foods. Disclosure of code meanings by food manufacturers to the New Jersey Department of Health on request by the latter.

B. Adoption of the open date of manufacture labeling on all outer cases/overwraps, etc., to assist in stock rotation.

C. Voluntary coding of all individual containers in such cases/overwraps by the food industry with codes of its own choosing (similar in intent to A. above). Such codes should indicate plant location, date of manufacture of final product in container, shift, production line, and any other aspects of products, at the manufacturer's discretion.

D. Stamping of date of shelf display by retail stores for stock rotation and as a consumer aid in home storage stock rotation.

E. Expansion of instructions for consumers' use and storage, i.e., "Do not store in a hot humid place" versus "Store in a cool dry place." In addition, resealing after opening will prevent moisture absorption, as will storage in air tight containers.

III. TYPE OF FOOD AND PRODUCT GROUP

Sugar, by category and variety

<u>Product category</u>	<u>Percentage of total sales</u>	<u>Product variety</u>	<u>Percentage of dept. sales</u>	<u>Percentage of total sales</u>
Sugar	.762	Granulated cane	81.4	.620
		Brown	8.8	.067
		Powdered	4.4	.034
		All others	5.4	.041
			100.0	.762

Source: From "Baking Needs," in Chain Store Age, 1969 Supermarket Sales Manual (1), Lebhar-Friedman, Inc., New York, N.Y., July 1969. Used with permission of publisher.

The categories of sugar are of several grades of crystal sizes which vary in fineness of grind from so-called powdered sugar to the considerably finer grind of confectioners sugar, tablets, and cubes.

IV. TYPE OF PROCESSING AND PRESERVATION

The cane and beet sugar processes differ substantially. Essentially, they involve extracting the raw sugar with water from the cane or beets to form a water solution and evaporating this solution after purification to dryness to produce sugar crystals. The various stages of clarification, decolorization, and filtration are followed by several stages of crystallization to remove minerals, molasses, and nonsugar materials. Concentration of sugar solutions is carried out in vacuum pans. The desired crystal size is controlled during the final vacuum cooking. Traces of syrup (molasses) residues are removed by washing with water while centrifuging. White granulated sugar receives a final drying with hot air. It is then stored in bulk for later packing in cartons or paper bags.

Tablet and cube sugar is made by pressing a mixture of crystallized sugar and sugar syrup into molds, followed by drying with heat. This form is usually packed in cartons.

Brown sugar is produced in one or more grades of color by the refining process so that a controlled amount of molasses remains. It is packed loose in cartons and paper bags.

Powdered or confectioners sugar is made by grinding or pulverizing sugar crystals to the desired degree of fineness. Three percent cornstarch is frequently added to minimize caking.

Sugar does not require preservation precautions other than the conventional wrapping and storage at room temperature, i.e., at a temperature not to exceed 100°F. and relative humidity not above 60 percent.

V. QUALITY CHARACTERISTICS

Color, grain size, and freedom from lumping are main aesthetic qualities of sugar.

Sugar consists only of carbohydrate and, except for the small amount of residual minerals in brown sugar, has no other nutritional value. It serves as a source of caloric nourishment and as a sweetener. Its other functional properties are used in baking and cooking. The ready solubility of sugar in water makes it usable as a bodying agent for syrups, cake fillings, icings, and beverages. Its foaming capability is used in making cake batters. The caramelization of sugar at high baking temperatures is used to obtain a desirable light brown color on the surface of various baked products.

Brown sugar is used more for its color and flavor than for its sweetness in various home kitchen operations such as cakes, cookies, and glazing.

VI. PROCESSING AND STORAGE QUALITY LOSS FACTORS

Sugar, when stored under the general conditions mentioned above, poses no potential health hazards because there is no microbial growth and no significant chemical change. Also, there is no loss of palatability during storage.

The principal objectionable development in sugar that may occur during storage is lumping or caking due to unfavorable atmospheric moisture conditions. There is little or no likelihood of lumping in white granulated or tablet and cube sugar unless exposed to humid conditions. Lumping may occur in powdered or confectioners sugar if unprotected by the addition of moisture-absorbing cornstarch; it may occur despite the presence of added cornstarch if subject to excessively unfavorable conditions. Brown sugar is more vulnerable to lumping or caking, especially after the package has been opened and stored in the consumer's home, because of moisture caused by the coating molasses syrup.

Lumping and caking can be caused by the drying out of moist sugar. If sugar is exposed to moist air, i.e., over 60 percent relative humidity, it is likely to absorb moisture from the air which dissolves traces of sugar on the surface of crystals. When the sugar is subsequently exposed to drier air, this added moisture again evaporates, leaving the dissolved traces of sugar as a cement between crystals, resulting in caking.

Brown sugar contains 2-4 percent moisture. If brown sugar is exposed to dry air, some of this moisture evaporates and results in caking. This condition readily occurs during home storage of opened packages (#20FIS).

With respect to identification of potential causes of quality losses and practices for quality maintenance, an industry source (#20FIS) stated:

"Caking of sugar is the result of several interrelated factors.

"(a) Absorbed moisture--primarily the result of exposure to high humidity.

"(b) Points of contact between the crystals.

"(c) Pressure, for example, that imposed by piling sugar.

"Of the three above-mentioned factors, absorbed moisture is probably the most significant since caking is the result of drying of a moist sugar. However, the severity of caking has been found to be dependent upon how moist the sugar was before drying out.

"With the conditions that cause caking in mind, the following are suggested for satisfactory storage. While a rather wide range of temperature and humidity is indicated it is, of course, very desirable to maintain the storage conditions at a relatively uniform temperature and humidity as marked fluctuations should be avoided for the most satisfactory storage. This advice applies to all grades of sugar.

TEMPERATURE
not above 100°F.

HUMIDITY
not above 60%

"The following precautions will help provide more satisfactory storage.

"1. Heating the warehouse air to reduce or control the humidity.

"2. Keep pile heights to a practical minimum.

"3. Provide air circulation by leaving a space of one foot between pile of sugar and wall. Sugar should be placed on wooden platforms to allow air space between the bags and the floor. This platform may be covered with a layer of asphalt paper and a layer of plain paper before placing the bags.

"4. If possible, sugar should be stored separately to avoid pick up of moisture from damp commodities, absorption of odors and possible insect infestation.

- "5. Powdered sugar packed without cornstarch should be stored for only relatively short periods of time and in the driest location available or under conditions that are somewhat lower than those specified for granulated sugar in packages and bags. Particular care should be taken that the sugar does not get a chance to absorb moisture. If powdered sugar cakes or hardens, there is no practicable way whereby it can be reconditioned satisfactorily. Therefore, every effort must be made to prevent caking of powdered sugar packed without cornstarch.
- "6. Brown or soft sugars, since they contain between 2%-4% moisture when produced, are more susceptible to caking, particularly when humidity conditions are low. Therefore, to prevent the loss of moisture, brown sugars must be stored under conditions of relatively high humidity at medium temperatures. Temperatures ranging from 40° to 75°F. with relative humidities between 60%-70% will adequately protect the sugar and keep it in a soft condition. Temperatures appreciably lower than the lowest shown should also be avoided since they will solidify the syrup surrounding the sugar crystal and result in an unworkable product, although usually no harmful effects will result - the sugar returning to its original 'soft' state upon subsequent warming to room temperature.
- "7. General Precautions. Sugar of any kind stored under prolonged conditions of high humidity may deteriorate through partial inversion of the sugar. Storage in hot locations for extended periods of time can gradually darken the color of granulated sugar. Therefore, they should not be stored next to radiators, boilers, etc."

The same company (#20FIS) markets its granulated sugar in sealed paper bags and in cartons. Its tablets and cubes are also packed in cartons. This company's brown sugars are packed in transparently overwrapped cartons having moisture protective inner liners of polyethylene. Powdered and confectioners sugar is packed in cartons fitted with protective liners.

No special environmental conditions are provided for transportation and storage of sugar, except to avoid temperature and moisture extremes. Company #20FIS, in its suggestions to its distributors and retailers on storage of sugar, advocates heating of warehouses to keep relative humidity as low as possible, minimizing temperature fluctuations, and avoiding storing sugar near other high-moisture commodities.

Company #20FIS considers refined granulated sugar to have unlimited shelf-life expectancy, and stated that its retail shelf turnover of granulated sugar is on the average of every 2 weeks. There is, therefore, relatively little chance for caking to occur before sale.

This company's brown sugars are judged to have a shelf-life expectancy of 6 months under normal conditions. Excessively long storage, particularly at high temperatures, may cause some darkening of color. Caking and lumping, however, are minimized by rapid turnover. The shelf life of its confectioners-powdered sugar is considered to be unlimited under normal conditions.

VII. PRESENT PRACTICES OF CODE DATING/PUBLIC DATING

A. Voluntary Food Industry Code Dating and Monitoring

A leading sugar refining company (#20FIS) provided the following information:

"1. Monitoring. We have no monitoring program for our products because of their rapid movement in the stores. Most of our products are sold in larger stores and supermarkets with an average storage time of about two weeks. No code marking is employed to signify an 'expiration' date because it is not felt to be necessary. If any products are found to be in an unsatisfactory condition, they are recalled.

"Coding is practiced on all granulated sugar and brown sugar products by date of packing, plant."

"Paper bags--overwrap coded, plant, shift, date of pack.

Cartons--individual cartons coded, plant, shift, date of pack
(machine #).

Tablets--overwraps coded, plant, shift, date of pack.

Cubes--individual cartons coded, plant, shift, date of pack.

Brown sugar--individual cartons coded, plant, shift, date of
pack (machine #).

Poly bags--overwraps coded, plant, shift, date of pack.

Specialty brown sugar--cartons coded, plant, shift, date of
pack (machine #).

Confectionery sugar--cartons coded, plant, shift, date of pack."

B. Legal or Required Dating

1. Federal--There are no Federal requirements for public dating. The FDA regulations contained in the Federal Register, April 26, 1969, Good Manufacturing Practices, indicate that the FDA would like code dating for interstate and intrastate commerce shipments.

2. State and (3) Municipal--No dating or coding requirements uncovered.

4. Foreign--No distinct requirements (see Legal Report, appendix II).

C. How Dating Influences Quality Maintenance: Advantages and Disadvantages of Dating

Rapid turnover of sugar in stores, especially in supermarkets, is generally responsible for keeping these products free from possible lumping and caking until sale. No health hazards exist. Prolonged storage in damp cellars may result in lumping and caking, or start development of conditions which can result in caking by the time the consumer opens the package. Open dating would not prevent any of these conditions.

VIII. FOOD PRODUCT ITEM LIST

A. Shelf Life--Food Industry Sources (FIS)

<u>Food item</u>	<u>Time*</u>	<u>FIS No.</u>
Brown sugar	6M	20
Brown sugar, granulated	Unlimited	20
Confectioners sugar	Unlimited	20
Granulated	Unlimited	20

*M = month.

Company #20FIS stated:

"1. Refined Granulated Sugars

"A. Shelf-Life Expectancy--The shelf-life expectancy of refined granulated sugars is unlimited under normal conditions. Storage has no significant effect on color, flavor and texture or on the nutritive value and there is no significant internal chemical or microbial deterioration. There is also no product failure attributable to storage. The turn-over of our refined granulated sugars in stores is an average of two weeks, so that there is relatively little chance of any significant change such as caking because of moisture absorption or subsequent loss from drying out. Refined granulated sugar is a very stable product.

"2. Brown (Soft) Sugars

"A. Shelf-Life Expectancy--Brown (soft) sugars are packaged for about six months life expectancy without a significant change under normal conditions. Caking and lumping are the most common effects of storage.

"3. Brownulated Granulated Brown Sugar in transparent over-wrapped carton

"A. Shelf-Life Expectancy--Shelf-life expectancy of Brownulated...Brown Sugar is unlimited under normal conditions because it is a dry (less than 1% moisture) product. Some lumping may occur from excessively long storage. Storage causes no loss of nutritive value nor internal chemical or microbial deterioration. Storage causes no change in color, flavor and texture and no product failure.

"4. Confectioners 10X Powdered Sugar with 3% cornstarch added to prevent caking (protective lined carton)

"A. Shelf-Life Expectancy--The shelf-life expectancy of Confectioners 10X Powdered Sugar is unlimited under normal conditions. Storage causes no loss of nutritive value nor change in color, flavor, and texture. Storage causes no internal or microbial deterioration and no product failure."

IX. RECOMMENDATIONS ON BEST MEANS OF FOOD QUALITY MAINTENANCE

A. Through Dating/Coding

No recommendations are made for a mandatory open-dating requirement on packages of sugar, because lumping or caking is generally caused by unfavorable atmospheric conditions which can result in objectional conditions within any designated shelf-life period.

The date of shelf display would help to rotate stock and to remind the consumer about how long a humidity-sensitive product has been on the home shelf.

B. Other Means of Quality Improvement

The instruction "Do not store in hot humid places" versus "Store in a cool dry place" may be more beneficial to consumers. In respect to brown sugar, labels should also advise consumers to fold down liners and store in a secondary air-tight container to help prevent lumping, which is a household problem common to such products.

X. REFERENCES

- (1) Chain Store Age, 1969 Supermarket Sales Manual, Lebhar-Friedman, Inc., New York, N.Y., July 1969.

BABY FOODS

I. INTRODUCTORY REMARKS

This line of specialty products ranks high in concern among legislators and public health agencies with reference to consumer protection against deterioration caused by age. For this report, the product group has been divided into three product categories: (A) items of a general nature, which are heat-processed in cans or jars, both being combined and termed "canned" for our purposes; (B) dry cereal products including biscuit and cookies; and (C) wet or dry "formula-type" products.

Group (C) serves mainly infants under 6 months of age. Category (A) has two product variety groupings, strained and junior foods, the latter intended for older children with better chewing capabilities. The dry cereals (B) are wet before serving, and intended for children as early as 3 weeks of age, often as the first introduction to solid food. Within these groupings, there is a proliferation of formulations and varieties that provide a tremendous choice of menu and diet. Among baby food products, canned foods make up 83 percent of the sales. While the group has unquestioned nutritional and economic significance, in light of possible selective coding or durability requirements, it seems judicious to deal with baby foods separately from adult foods and to distinguish among the foregoing three groups. The total supermarket sales volume of the group, 0.63 percent, is small compared with general canned foods which has a volume of 8.38 percent. This group, however, represents \$340 million of sales volume.

II. SUMMARY OF RECOMMENDATIONS

A. Adoption by the New Jersey Department of Health of the coding recommendations of the FDA Good Manufacturing Practices, Federal Register, April 26, 1969, for processed foods. Disclosure of code meanings by food manufacturers to the New Jersey Department of Health on request by the latter.

B. Adoption of the open date of manufacture labeling for all outer cases/overwraps, etc., to assist in stock rotation.

C. Voluntary coding of all individual containers in such cases/overwraps by the food industry with codes of its own choosing (similar in intent to item A. above). Such codes should indicate plant location, date of manufacture of final product in container, shift, production line, and any other aspects of products, at the manufacturer's discretion.

D. Stamping of date of shelf display by retail stores for stock rotation and as a consumer aid in home storage stock rotation.

E. Expiry dating of all infant formula dietary products, whether canned or dried, to assure product rotation on a quality basis, recognizing that outdated products do not necessarily produce health hazards, simply lower quality.

III. TYPE OF FOOD AND PRODUCT GROUPS

Baby Foods, by product group, category, and variety

Product group	Percent- age of total sales	Product cate- gory	Percent- age of cate- gory sales	Percent- age of total sales	Product variety	Percent- age of depart- ment sales	Percent- age of total sales
Canned products (A)	.525	Dinners, regular	20.6	.130			
					Junior Strained	11.0 <u>9.6</u> 20.6	.069 <u>.061</u> .130
		Fruits	17.6	.111			
					Junior Strained	6.8 <u>10.8</u> 17.6	.043 <u>.068</u> .111
		Desserts	12.5	.079			
					Junior Strained	5.0 <u>7.5</u> 12.5	.032 <u>.047</u> .079
		Meats	9.7	.061			
					Junior Strained	3.3 <u>6.4</u> 9.7	.020 <u>.041</u> .061
		Vegetables	7.3	.046			
					Junior Strained	1.5 <u>5.8</u> 7.3	.009 <u>.037</u> .046
		Juices	7.4	.047			
		Dinners High protein	3.8	.024			
					Junior Strained	2.0 <u>1.8</u> 3.8	.013 <u>.011</u> .024
		Combinations	2.3	.014			
					Junior Strained	.7 <u>1.6</u> 2.3	.004 <u>.010</u> .014

Source: Chain Store Age, 1969 Supermarket Sales Manual (1), Lebhar-Friedman, Inc., New York, N.Y., July 1969. Used with permission of the publisher.

Product group	Percent- age of total sales	Product cate- gory	Percent- age of cate- gory sales	Percent- age of total sales	Product variety	Percent- age of depart- ment sales	Percent- age of total sales
		Soups	2.0	.013			
					Junior Strained	1.0 <u>1.0</u> 2.0	.007 <u>.006</u> .013
			<u>83.2</u>	<u>.525</u>			
Dry cereals (B)	.037	Cereals, dry	4.8	.030			
		Biscuits, cookies, etc.	.5	.003			
		Others	<u>.7</u>	<u>.004</u>			
			6.0	.037			
Formula types (C)	.068						
		Formula	<u>10.8</u>	<u>.068</u>			
			100.0	.630			

IV. TYPE OF PROCESSING AND PRESERVATION

"Canned" products comprise 83 percent of baby food sales. There are no thermal processing differences between adult canned foods and baby canned foods. The processing of instantized precooked cereals is more or less self-explanatory, and involves par- or precooking of the products followed by dehydration and packaging. Preparation of canned baby products differs from adult foods in pureeing and straining steps.

V. QUALITY CHARACTERISTICS, VI. PROCESSING AND STORAGE QUALITY LOSS FACTORS, VII. PRESENT PRACTICES OF CODE DATING/PUBLIC DATING, and IX. RECOMMENDATIONS ON BEST MEANS OF FOOD QUALITY MAINTENANCE have been combined. Sections VII. B. Legal or Required Dating and VII. C. How Dating Influences Quality Maintenance are covered in the Canned Foods chapter of this report.

Whether dried or canned, the nutritive values examined in this survey are comparable to those of adult canned foods. Baby foods provide calories for energy, protein, fat, carbohydrates, minerals, and vitamins for sustenance and growth. With the possible exception of formula products, baby foods are not commonly vended as medicines with claims for complete nutritional balance. Supplementary milk is relied on in baby diets, and supplemental vitamins (often with added minerals) are provided daily in

the United States, usually under pediatric supervision. This survey is concerned with baby foods as foods and not as medicines or nutritional supplements. Formula baby foods constitute slightly under 11 percent of the supermarket sales of this department and will be discussed separately below.

The dry cereal varieties and canned products have quality stability criteria that are comparable to adult canned foods. The dry cereal varieties are principally of the precooked, instantized types, and include such items as oatmeal, combined oatmeal and fruit products, and high protein cereals. They are packed in sealed, coded cartons. For the canned products, a minimum shelf life of 2 years is expected by a large manufacturer (#380FIS), based on deterioration criteria such as color, texture, flavor, and visual appearance. The coding system, which was not revealed to the survey team, is relied on principally for assuring stock/monitoring and rotation. Visible deterioration is noted by trained salesmen who are instructed biannually by the company's quality control staff. The salesmen are instructed to withdraw anything they consider to be questionable quality. Cereals in fiber boxes are monitored for a maximum of 1 year shelf life with instructions to withdraw products from the market if they exceed this age.

To establish shelf life, the above producer runs storage stability tests at room temperature for a 2-year period with additional accelerated tests at 90°F. Rapid discoloration is anticipated when storage is under adverse conditions. One manufacturer (#380FIS) believes that 60 percent of his products are being purchased and consumed within 6 months of production with the exception of seasonal goods. Within 1 year, 75 percent of all his products are consumed and nearly 100 percent are consumed within 2 years from the date of the pack.

As in the canning industry, the baby food line has seasonally canned varieties, which necessitates carryover of stock for at least a year in a portion of line items.

Fruit juices are a special case and are somewhat analogous to formula products. Their presence in infant diets is based mainly on their vitamin C content. One producer (#380FIS) stores his products in cold warehouses with temperatures of 50°F. while the products are under his control to preserve and maintain maximum vitamin C levels. Since this potency diminishes slowly at room temperature, rapid distribution and retail turnover are encouraged to assure consumption before the loss of vitamin C is significant.

Another manufacturer (#470FIS) has extremely detailed systems for surveillance of strained juices that rely on internal and external inventory controls with a variety of digital and alphabetic coding symbols. "Old age" (Step 1) is regarded as 6 months for apples and prune items; other juices are considered "old age" at 12 months. Six additional months are permitted before "sales action" (Step 2) is required. On "old age" products, automatic "pickup for destruction" (Step 3) follows after 3-6 more months for these highly sensitive juices (a total of 15-18 months maximum shelf life following packing) with a further 6 months allowed for more stable juice varieties (a 21 to 24-month total).

Precooked cereals have shortened terms for each of these three control phases, i.e., Steps 1-3. Three months are regarded as "old age," and the subsequent steps are at 6 months and 9 months, with destruction planned at the latter age.

Strained food items with fruit bases have comparably short shelf-life terms, with the three steps of action being 3, 9, and 12 months. Other similar products are regarded as being "old age" at 12 months, with a lesser number at 18 months. Solid products containing fruit usually are keyed for pickup and destruction at 18 months. Meat, soup, and vegetable products are keyed in accordance with tested durability programs and are predominantly 24 months old before final pickup (Step 3), with some products being stable to 30 or 36 months. In mitigation of these last high numbers is the fact that the manufacturer has earlier (Steps 1 and 2) stages of inventory surveillance and action at 12 months and 18 months in these cases. The sophistication of this system demonstrates that there is apparently intelligent conscious quality control and detailed testing procedures associated with the age-decision points of this major producer. Company #470FIS stated:

"With the exception of the dehydrated food items in the baby cereal area, these products are all processed in either tin or glass and, therefore, have a long shelf life and stability dependent upon temperature, storage, and humidity of storage area. Under normal storage conditions, these products will last for two to three years time without major deterioration."

Another producer (#110FIS) has documented his shelf-life durability schedules methodology, based on normal storage and accelerated storage studies (see below). Vitamin C in juices and desserts is traced with relation to time and temperature; the results are comparable to those of source #380FIS. They both test for and show vitamin loss and discoloration at warm temperatures and 1-year storage. Meat-based dinners have long shelf lives and are acceptable in all organoleptic factors after 18 months at room (72°F.) storage temperatures.

Vegetables are less sensitive and, except for instances of color loss in glass containers, can be stored satisfactorily for 2 years. Cereal shelf life is formulation and package-dependent. Without adequate protection from the packages, cereals may develop slightly rancid odor after 6 months and become objectionable after 1-year storage (see below).

This same manufacturer (#110FIS) provided the following information on his shelf-life testing procedures which exemplify good practices:

"I. Accelerated Storage Studies

Studies are conducted on pilot plant and experimental production samples. The products are subjected to the following:

- "A. Freeze & Thaw (15 cycles). The products are then checked at intervals for changes in appearance, texture, and aroma. Special attention is given to free fluids, plugs, 1/ starch pockets, striation or any set backs.
- "B. 40°F. & 98°F. (20 cycles). Products are checked for appearance, texture, and aroma. Attention is given to plugs or set backs, striation, free fluid or any abnormal signs.
- "C. 98-100°F. Incubation. After 30-days incubation, products are checked for pH changes, consistency, vacuum. Also check for obvious changes in appearance, texture, and aroma."

"II. Normal Storage Studies

"Processed baby food jars are stored at 3 temperatures, 40°F., 70°F., and 100°F. and checked over a period of 1 year and a half at 3 months intervals. The products are evaluated by an expert panel for appearance/color, texture, and flavor. Objective color analysis, proximate analysis and other attributes are done on products when applicable.

"Below find stability studies on each product categories. These data are general for that category and do not include each product within a category.

"Juices

Juices are packed in...cans. In general, juices show no significant differences in appearance/color, aroma and flavor after 1 1/2 years of storage at 40°F., but show slight color change when stored at 70°F.

Storage for 1 1/2 years at 40°F. and 70°F. showed no changes in pH, acidity or brix, but slight decrease in vitamin C and slight increase in tin and iron. When juices were stored at 100°F. they became objectionable after 1 year of storage.

"Desserts

Desserts are packed in...glass jars for both strained ...junior foods.

Storage studies after 1 1/2 years at 40°, 70°, and 100°F. showed no significant changes in appearance/color, texture, and flavor. Vitamin C content dropped slightly when products

1/ "Plugging is a defect in which the food material becomes semisolid and contracts to some degree. This is usually accompanied by syneresis with an unattractive layer of water surrounding the plug. In foods containing starch, this is caused by retrogradation of the starch caused by extensive hydrogen bonding. In its worst form, it is possible to shake a plug back and forth within a container."

were stored at 40°F. and ambient temperatures but substantial decrease was noted when products were stored at 100°F. Products stored at 100°F. darken in color and deteriorate slightly in flavor.

"Fruits

Fruits are packed in...glass jars. Accelerated storage studies showed no bad effect on products. Prolonged storage for 18 months showed that products were acceptable when stored at 40°F. and 70°F. but objectionable when stored at 100°F. Some fruits showed slight color changes.

"Meat Base Dinners

Products are packed in...glass jars. Accelerated studies showed no bad effects on products. Prolonged storage studies showed that products were acceptable in appearance, texture and flavor when stored for 18 months at ambient temperature. Plugging was noted on some products when stored at 40°F.

"Vegetables

Accelerated studies showed no bad effect on product.

Prolonged storage studies after 2 years at ambient temperature showed no perceptible differences in appearance, aroma, texture and flavor.

Yellow vegetables showed slight darkening in color.

"Infant Cereal

Infant cereals (are packaged) in...boxes...

Generally, the cereal undergoes 1 1/2 years of stability testing in which product is packaged in variety of packaging material, either overwrapped or not. Packages are stored at 70°F. and 100°F. at ambient humidity. In addition a moisture pick-up test is made by storing packages at 85°F./75% relative (humidity).

Stability studies are conducted with variety of packaging material, either plain or overwrapped. Accelerated storage studies are made at 100°F. and 85°F./75% relative humidity. Normal storage at 70°F. is done for a period of 1 1/2 years.

Products are then evaluated by an expert panel for appearance, aroma, flavor, reconstitution and any other abnormalities. In addition color analyses and vitamin analyses are made on the products.

In general, cereals are acceptable for 1 1/2 years in plain boxes. Product in some overwrapped material give slight rancidity odor and cardboardy aroma after 6 months. This odor becomes objectionable after 1 year of storage."

This same source (#110FIS) also provided information on consumer testing of products:

"Birth lists are purchased by territory so we have the mailing addresses of mothers with new babies in the areas in which we are interested. These mothers are sent an introductory letter explaining the function of the (tests) along with a card to be filled out and returned, if she cares to participate in our testing program. The returned cards are processed and the names put on computer tape. There are several advantages in using this procedure. Namely - the mother has agreed to do some testing for us and the percentage of questionnaires returned is much higher than would be the case if unsolicited samples were sent. Panels can be easily selected by age of the baby (in months) and also by territory, so we are able to request that group of babies who would normally to be of an age to be eating the test baby food. There is a monthly up-dating of the babies by age so the panel is always current. At 12 months of age the babies are "retired" and then used...for tests on (food for young children), where a panel of children in the 12 to 18 month old age group is used.

"Baby food test products are carefully prepared. Where regular production samples are used (these may be both (our) samples and a leading competitor's sample), the jar caps are buffed to efface brand identification. Product labels are removed and experimental labels affixed to the test samples. These experimental labels are imprinted with the product name, complete list of ingredients, net weight, and an identifying code number. Products having meat or poultry as an ingredient, must also show our establishment number and require clearance from Washington before the test products can be labeled. By using our establishment number on the experimental label for a competitor's product, we assume responsibility for his product. Much the same procedure is used when experimental... products are prepared for testing.

"A set of test samples is usually one jar of each of the test products - 2 samples per test. Each set of test samples is accompanied by a letter of instruction to the mother outlining the test procedure to be followed and a questionnaire which she is asked to complete and return to us. As the mother is accustomed to her own baby's reaction to various foods, she is able to decide how well the baby liked the test samples, and record her baby's reaction on 9-point hedonic scales provided on the questionnaire. We are also interested in mothers' reaction to the samples so she is asked to taste them and record her opinion, also on 9-point hedonic scales. Space is provided for comments and suggested product changes which she thinks might make the product

more acceptable to her baby. By using hedonic scale ratings, test results can be subjected to statistical analysis. A summary of the comments also becomes part of the test report."

The foregoing manufacturers use different detailed standard practices, but their quality criteria, durability experiences, and administrative controls are interestingly similar. Each has special recognition of the shorter durability of fruit juices, fruit-containing products, and dry cereals. Taken together, their product volume constitutes well over three-quarters of this country's baby foods.

With regard to the above nonformula (or nonmedicinal) baby foods, the survey team recommends that the food industry be allowed to continue to evolve and refine the good quality control practices it manifests. Competitiveness, consumer good will, and enlightened self-interest seem adequate spurs to product safety and quality. In addition, to benefit the stated inventory and turnover programs, the exterior cases, cartons, or overwraps should be coded in English with the date of manufacture to correct stock rotation in channels of distribution and retail store levels. For consumers' chronological information and to assure correct shelf stocking procedures, the individual packages should be dated by the retailer with date of shelf display.

Formula-Type Baby Foods

Formula foods are in the medicinal-type or special dietary category because they are usually specifically prescribed or endorsed by physicians and clinics and are sold in pharmacy outlets as well as in food markets. Their sales volume in supermarkets constituted only 0.07 percent of total sales (or \$36.7 million) in 1968. ^{2/} Assuming that an equal volume is sold through drug stores and smaller retail stores, the 1970 total dollar volume is expected to be less than \$100 million. Though of considerable importance for infant feeding when diet is critical, the economic stature of these products is dwarf-like vis-a-vis the food retail business of the other baby foods. Any special conditions that seem desirable regarding dating or expiry should be restricted to this narrow band since these products differ from others in providing "complete" dietary needs of infants.

Formula baby foods are either canned fluid concentrates, ready-to-feed liquids which require no further preparation, or dried mixes that are predominantly milk-based or simulate milk. The leading formulas simulate breast milk, are lower in protein than cows' milk, contain added carbohydrate, and usually one or more vegetable oils. They are vitamin-fortified and supplemented with minerals and metals. Soy protein is used to replace milk protein for hypoallergenic formulations. Milk fat is commonly replaced with vegetable oils and sometimes "oleo" in attempted simulation of mother's milk. In addition to carbohydrate and fat, a variety of minerals and vitamins are added to produce a nutritionally complete product which will support normal growth as the sole article of the diet.

^{2/} Manufacturer #735FIS reports a sales volume of \$48.1 million in 1969.

High protein cereals, containing about 35 percent protein, are in another special formula category. Through selection from several different sources of protein, biologically balanced mixtures of amino acids are provided. This is required because certain essential amino acids are often lacking in infant diets of some ethnic groups, sometimes for religious reasons, and these formulations supplement lysine, methionine, and tryptophan. Fiber and fat are low and rely on milk for the latter.

Whether cereal or milk-based or mixtures of these, the commercial products are proprietary formulas representing nutritional and medical sophistication. Animal test-feeding and clinical testing are customary parts of their production, and stability testing is considered by the companies to be fairly advanced. Stability is judged by vitamin assays, protein assimilation tests, color quality, texture and noncaking qualities, bacteriological factors, and freedom from rancidity and other manifestations of quality deterioration.

Some principal manufacturers have case coding and package coding stating, "Use before (month) (year)." Canned formula products thus coded were presumed (by sample inspection by survey team members) to be advance-dated 24 months from date of manufacture. Another line of products has cryptic coding which was deciphered to indicate an expiry date which also appears to allow a 2-year shelf life. Product consumption after the expiry date is not anticipated to provide unacceptable, harmful, or unnutritious products. One stated company policy is that expiry dating does not include stock replacement or compensation to the vendor, but simply forces vendors to rotate stock intelligently and to assure sales movement before expiry dates, thereby promoting the best possible quality for the consumer. It appears that open expiry dating by all producers of such formula-type products deserves to be endorsed for this especially sensitive line of pediatric or formula infant foods--not on the grounds of possible health hazards but rather for general quality and as a salutary practice by all producers.

Manufacturer #735FIS, which expiry dates its liquid formula 18 months from date of production, reported:

"We receive a disproportionate share of complaints from users of out-of-date products. Normally product will break--whey off--on fat emulsion instability. These distract from the organoleptic properties, not so much from the nutritional value of the formula."

VIII. FOOD PRODUCT ITEM LIST

A. Shelf Life--Food Industry Sources

<u>Food item</u>	<u>Time*</u>	<u>FIS No.</u>
Canned baby foods	2Y	380
Cereals	1½Y	110

*Y = year, M = month.

<u>Food item</u>	<u>Time</u>	<u>FIS No.</u>
Cereals	1Y	380
Desserts	1½Y	110
Formula	18M	735
Fruits	1½Y	110
Juices	1½Y	110
Meat dinners	1½Y	110
Vegetables	2Y	110

IX. RECOMMENDATIONS ON BEST MEANS OF FOOD QUALITY MAINTENANCE

Recommendations were included throughout this chapter.

X. REFERENCES

- (1) Chain Store Age, 1969 Supermarket Sales Manual, Lebhar-Friedman, Inc., New York, N.Y., July 1969.

Chapter 16

NUTS

I. INTRODUCTORY REMARKS

The discussion of nuts is limited to in-shell and shelled nuts. Shelled, roasted, and salted nuts are discussed under "snacks," which are included in the department classification of Bakery Products and Supplies by Chain Store Age (1).

In-shell and shelled nuts are principally used as snacks and as ingredients in homemade baked goods, confections, salads, and cooked foods. Peanut butter is discussed under "Desserts."

II. SUMMARY OF RECOMMENDATIONS (see also section IX)

A. Adoption by the New Jersey Department of Health of the coding recommendations of the FDA Good Manufacturing Practices, Federal Register, April 26, 1969, for processed foods. Disclosure of code meanings by food manufacturers to the New Jersey Department of Health on request by the latter.

B. Adoption of the open date of manufacture labeling on all outer cases/overwraps, etc., to assist in stock rotation.

C. Voluntary coding of all individual containers in such cases/overwraps by the food industry with codes of its own choosing (similar in intent to A above). Such codes should indicate plant location, date of manufacture of final product in container, shift, production line, and any other aspects of products, at the manufacturer's discretion.

D. Stamping of date of shelf display by retail stores for stock rotation and as a consumer aid in home storage stock rotation.

E. Expansion of instructions for consumers' use and storage to include statements, "Do not store transparent packages in direct or artificial light"; "Store nuts in refrigerator at all times."

III. TYPE OF FOOD AND PRODUCT GROUPS

Nuts, by product group, category, and variety

<u>Product group</u>	<u>Percentage of total sales</u>	<u>Product category</u>	<u>Percentage of category sales</u>	<u>Percentage of total sales</u>
Nuts	.37			
		Peanuts	22.4	.083
		Walnuts	22.3	.082
		Mixed nuts	16.2	.060
		Pecans	14.6	.054
		Cashews	8.8	.033
		Almonds	4.0	.015
		All other packaged nuts	9.2	.034
		Loose, bulk nuts	2.5	.009
			<u>100.0</u>	<u>.370</u>

Source: Chain Store Age, 1969 Supermarket Sales Manual (1), Lebhar-Friedman, Inc., New York, N.Y., July 1969. Used with permission of publisher.

In-shell mixed nuts frequently included in assortments are walnuts, almonds, pecans, Brazil nuts, filberts, and peanuts. In-shell roasted peanuts often reach the consumer at large amusement gatherings such as circuses and ball games. Other nuts reaching the consumer in-shell are black walnuts, pistachio nuts, and possibly macadamia nuts, as well as coconuts, chestnuts, cashew nuts, and others. Virtually all of these may be sold at times as shelled nuts in cans, jars, or film packs for eating as is or for cooking purposes.

IV. TYPE OF PROCESSING AND PRESERVATION

In-shell nuts are normally cleaned after harvesting. Whether they grow in clusters or singly, extraneous leaves or outer pulpy materials are first removed from the shells by separation or mechanical crushing.

Unless carefully protected, especially after having been shelled, nuts are readily susceptible to insect infestation. Fumigation with such gases as methyl bromide is frequently utilized. To minimize danger of insect infestation, good housekeeping methods are essential throughout the industrial handling operations.

Both in-shell and shelled nuts are graded for size, color, and degree of perfection by the processor. The Consumer and Marketing Service of USDA has established grade standards for in-shell and shelled nuts. Observance of

these grade standards is optional. Inspection service may be obtained by the processors by payment of the designated fees. Use of this inspection and grading service enables the processor to designate the appropriate USDA grade on package labels. This inspection service is of particular value to the consumer when buying in-shell nuts, where the actual edible product is not visible to the purchaser at the time of sale.

Refrigeration for long-term storage is essential. According to ASHRAE (2), "Refrigeration increases the merchantable life as much as 10 times, and may extend it 2 to 5 years; it serves to retain natural texture, color, and flavor; it retards staleness, rancidity, and molding for more than two years, depending on temperature; insect activity is arrested below 48°F. Other conditions being equal, the lower the temperature the longer the storage life. Life may be extended from two to three times with each 20 degree drop in temperature." Shelled nuts may be held from one harvest season to the next without appreciable loss in quality, but must be held at 36°F. or lower.

In-shell nuts, often assorted, are frequently packaged in single or double-wall cellophane pouches, or boxes with cellophane film windows. Shelled nuts are usually packaged in varying sizes of cans, jars, or film pouches having low gas and moisture vapor transmission characteristics. They may be flushed with nitrogen before sealing or vacuum packing.

Industry source #160 recommends storage of almonds at 32°F. and 60-70 percent relative humidity prior to consumer sale. Temperatures up to 40°F. prolong storage life over room temperature conditions, but are not ideal. For bulk storage of almonds, tins are preferred and should be vacuum-packed (28" vac.) or nitrogen-flushed. Successful storage is also possible in 100-pound polylined burlap bags and 25-pound polylined paper cartons. For storage of nuts in general, ASHRAE (2) recommends a relative humidity of 65-75 percent.

The Refrigeration Research Foundation (3) recommends specific storage temperatures and relative humidities for individual types of nuts. Generally, it recommends storage for all nuts at 32°F. with permissible ranges up to 50°F., but with correspondingly less storage life at the higher temperatures. The relative humidity ranges from 60 to 75 percent, depending on nut variety.

Since walnuts are highly susceptible to darkening and development of rancidity, their kernels, when removed from the shell, may be treated with combinations of such antioxidants as butylated hydroxyanisole, butylated hydroxytoluene, and propylgallate (4).

Despite the importance of refrigerated storage in prolonging the shelf life of nuts, virtually all sales displays are at room temperature (72°F). Most consumer storage is also at the same temperature.

Coconuts may reach the consumer markets with the outer husk removed, but much of the coconut reaching the consumer market does so in some processed form, such as sweetened, shredded, or grated.

V. QUALITY CHARACTERISTICS

Nuts are preferred for their characteristic flavor and relative brittleness. Kernels that are of uniform size, acceptable color, and show absence of shriveling and other characteristics of deformity are generally considered acceptable. They must be free of any rancidity.

While not currently used as major components of daily diet, the common types of nuts contain substantial amounts of protein and fat. According to data in USDA Handbook No. 8 (6), the protein content of almonds, pecans, walnuts (English), filberts, and brazil nuts ranges from 9.2 to 18.6 percent and the fat content of the same nuts ranges from 54.2 to 71.2 percent. One particular variety of walnut is reputed to be the world's richest food.

VI. PROCESSING AND STORAGE QUALITY LOSS FACTORS

McGeary and Smith (5) reported that:

"Rancidity is perhaps the worst enemy of kinds of nuts that are highest in fat. Generally speaking, nutmeats are 50 to 70 percent fat, except for coconuts that are 35 to 40 percent fat, and chestnuts with only a trace. The fat reacts with oxygen from the air to cause ... development of rancid flavor and odor."

In recent years, the presence of aflatoxin contamination in some peanut products has generated serious concern, even though contamination of No. 1 grade peanuts by *aspergillus flavus* is not prevalent in this country (7). In discussing the control of aflatoxin, Goldblatt (8) suggests that the best approach is to prevent its infection. Much recent knowledge has been gained which reduces the molds sharply during all stages of culture, harvest, transportation, and processing. This problem could not be solved in any way by limitation of shelf life or by dating.

If the nuts, especially when shelled, are exposed to higher temperatures, remain unprotected, or are exposed to unsanitary surroundings, they may become infested with insect life, which can develop later when exposed to room temperature. Shelled pecans have at times been contaminated with coliform bacteria. Under normal storage conditions, these organisms will not multiply.

An industrial grower (#160FIS) reported the following:

"1. Storage prior to consumer sale

We recommend a maximum temperature of 32°F. and a relative humidity of 60% to 75%. Temperatures up to 40°F. (in cool rooms) prolongs storage but is not ideal.

"2. Consumer display and sale

- a) We recommend the lowest temperature practicable and away from heat sources and direct sunlight.
- b) Maximum shelf life
 - 1) In-shell - One year at ambient conditions in double-wrapped cellophane container ("K" film).
 - 2) Shelled - Up to one year in polyethylene film.
 - 3) Oil roasted - In metal tin, w/antioxidant, up to one year, acceptable flavor and aroma.

(#2 and #3 in 40°F. cool, constant temperature)

"3. Consumer storage

We strongly advise against storage in warm rooms or in direct sunlight, regardless of the type of product or container. This applies especially to the flexible packages of all types.

We also urge customers at every level to store almond products under refrigeration, especially after the container has been opened."

VII. PRESENT PRACTICES OF CODE DATING/PUBLIC DATING

A. Voluntary Food Industry Code Dating and Monitoring

An industrial source (#160FIS) stated with respect to coding:

"This is done on the individual units and outer containers or cases. However, the coding system is confidential and is classified as proprietary information."

Company #530FIS dates some items with expiry dates on individual packages. Nuts with longer shelf life are coded for stock rotation.

Company #30FIS code dates all individual packages.

B. Legal or Required Dating

1. Federal--There are no Federal requirements for public dating. The FDA regulations contained in the Federal Register, April 26, 1969, Good Manufacturing Practices, indicate that FDA would like code dating in inter-state and intrastate commerce shipments.

2. State and (3) Municipal--No requirements were noted.

4. Foreign--There are no specific requirements (see Appendix II, Legal Report).

C. How Dating Influences Quality Maintenance: Advantages and Disadvantages of Dating

Dating alone does not assure maximum quality to the consumer because the stability of nuts is dependent on the conditions to which they have been subjected during storage, especially since nuts are seasonal products and are usually held over from one crop year to the next. Once the nuts are removed from refrigeration, storage stability recedes considerably, and original date of packing has no relationship to the final end of acceptability.

VIII. FOOD PRODUCT ITEM LIST

A. Shelf Life--Food Industry Sources

Company #160FIS considers the following maximum shelf lives for consumer display packages:

- (1) In-shell almonds: 1 year at ambient conditions in double-wrapped cellophane packages.
- (2) Shelled almonds: up to 1 year at 40°F. (constant temperature) in polyethylene film.

In general, shelf life is affected by various types of packaging. This statement is supported by the following data from #160FIS:

"Single film cellophane--not used in our operations.
Laminated pouches--Nitrogen flushed (roasted almonds)
up to one year at ambient conditions. (Poly/foil/poly)
Vacuum packed laminated pouches--Same as above.
CO₂--Not used because of its high absorption by almonds.
Metal containers--These are the best containers for
almonds, either treated or untreated with antioxidant.
Raw or roasted. It is far superior to all flexible films
known. All cut and roasted products are protected by
antioxidants unless otherwise indicated by customers.

"Containers--We prefer tins either vacuum packed (28" vacuum) or a nitrogen back-flush to atmospheric pressure. We do store in 100-lb. poly-lined burlap bags and 25-lb. poly-lined paper cartons.

"Raw, whole nuts will last up to three years if stored under the above conditions of temperature and humidity, if put in bags or cartons. A longer period can be expected if this product is placed in sealed tins.

"We feel that a one-year storage period is acceptable for a perishable product such as almonds and this commodity should be in the normal trade channels and consumed by this time period."

Company #530FIS, a large retail chain, has established the following schedule of handling for its bagged nut items:

Peanuts, blanched, Virginia's:	2 months, then remove from sale
Peanuts, Spanish:	6 weeks, do.
Mixed nuts, with peanuts:	2 months, do.
Mixed nuts, without peanuts:	3 months, do.
Pecan halves, pieces, chips:	3 months, do.
English walnuts, halves & pieces:	3 months, do.
Almonds:	3 months, do.
Fine ground nuts:	3 months, do.
Brazils:	no expiry date, long shelf-life items
Pistachios:	no expiry date, do.
Filberts:	no expiry date, do.
Black walnut chips:	no expiry date, do.

Company #30FIS, a large retail chain, has established the following shelf-life periods:

Assorted nuts	13 weeks
Canned nuts	1 year
Dry roast nuts	12 weeks
Regular roast nuts	10 weeks

B. Shelf Life--Scientific Sources

1. Quality factors--Woodroof and Heaton (9) give the following information regarding changes that can take place in pecans stored at various temperatures:

<u>Storage temperatures</u>	<u>Possible changes</u>
70°F.	Pecans are subject to molding at this temperature.
47°F.	Pecans are subject to molding, but insect life is arrested.

Storage temperaturesPossible changes

32 to 36°F.

Staling and rancidity develop gradually.

20 to 25°F.

No molding, insect damage, discoloration or rancidity. There may be slight staling and loss of flavor.

0°F. and below

No significant changes.

2. Shelf life--Pecan pieces have shorter storage life than pecan halves. Storage of pecan pieces should be limited to a few weeks or months at temperatures above 32°F. (8).

The following pages containing expected storage life periods are from the Commodity Storage Manual of Refrigeration Research Foundation, revised 1961 (3). They are included here with permission of the Foundation.

"STORAGE CONDITIONS & PERIODS

Clean, dry room
Air fresh of odors
Relative humidity controlled
Provision for air circulation
No contact with ammonia gas
Rodent and insect protection
Separate from other commodities
Tempering facilities, from freezer storage

"Unshelled nuts will store for about twice as long as shelled nuts, but most nuts are shelled to reduce the weight and space to about one-half. Shelled nuts absorb moisture and flavors readily, become "dirty" and stale easier, and consequently require good packaging and more careful handling."

	<u>Temperature</u> <u>°F.</u>	<u>Relative</u> <u>Humidity</u> <u>%</u>	<u>Expected</u> <u>Storage</u> <u>Life</u>
<u>Almonds</u>			
In shell	32-45	60-75	1 year or more
Shelled	32	60-75	1 year
Vacuum or gas pack	32-50	*	1-2 years
Frozen	0	**	1 year or more

	Temperature °F.	Relative Humidity %	Expected Storage Life
<u>Brazil Nuts</u>			
In shell	32-40	65-70	1 year
Shelled	32	65-70	6-9 months
Vacuum or gas pack	32-40	*	1 year
Frozen	0	**	1 year or more
<u>Cashew Nuts</u>			
Shelled	32-40	65-70	1 year
Vacuum or gas pack	32-40	*	1 year or more
Frozen	0	**	1 year or more
<u>Chestnuts</u>			
In shell	32-45	65-70	1 year
Shelled	32-34	65-70	1 year
Frozen	0	**	1-2 years
<u>Filbert (Hazelnut)</u>			
In shell	25-45	60-70	1-2 years
Shelled	35	60-70	1 year
Vacuum or gas pack	32-40	*	1 year
Frozen	0	**	1-2 years
<u>Macadamia Nuts</u>			
In shell	32-50	65-70	1-2 years
Shelled	32	65-70	1 year
Vacuum or gas pack	32-40	*	1 year
Frozen	0	**	1-2 years
<u>Pecans</u>			
In shell	32-50	65-75	9-18 months
Shelled	32	65-70	1 year
Vacuum or gas pack	32-50	*	1-2 years
Frozen	0	**	1-2 years
<u>Peanuts</u>			
In shell	32-50	65-75	9-24 months
Shelled	32	65-70	1 year
Vacuum or gas pack	32-50	*	1-2 years
Frozen	0	**	3 years
<u>Pistachio Nuts</u>			
In shell	32-50	65-70	1 year
Shelled	32	65-70	1 year
Vacuum or gas pack	32-40	*	1-2 years
Frozen	0	**	3 years

	<u>Temperature</u> <u>°F.</u>	<u>Relative</u> <u>Humidity</u> <u>%</u>	<u>Expected</u> <u>Storage</u> <u>Life</u>
<u>Walnuts</u>			
In shell	32-40	70-75	1 year
Shelled	32	70-75	10-20 months
Vacuum or gas pack	32-40	*	1-3 years
Frozen	0	**	1-2 years

*Relative humidity does not affect storage stability of nutmeats vacuum or gas packed, but should be 70% or lower to prevent rusting of metal containers.

**Relative humidity need not be controlled for nutmeats in freezer storage. The r.h. resulting from standard operating procedure is satisfactory.

"Like all other foods, nutmeats lose quality in storage. The lower the storage temperature, the longer their good quality is retained. Following is the relative good quality storage life at various temperatures for pecans and peanuts. The time-temperature relationships are also approximate for other nutmeats.

"Relative Storage Life, at Various Temperatures,
of Nutmeats in the Shell

<u>Temperature</u>	<u>Pecans</u> <u>Months</u>	<u>Peanuts</u> <u>Months</u>
70°F.	4	6
50°F.	9	9
32°F.	18	24
0°F.	24	48

Relative Storage Life, at Various Temperatures,
for Shelled Nutmeats

<u>Temperature</u>	<u>Pecans</u> <u>Months</u>	<u>Peanuts</u> <u>Months</u>
70°F.	3	4
50°F.	6	6
32°F.	12	12
0°F.	24	48

"All nuts are artificially or sun and air dried after harvesting. At the time of harvesting, most nuts have 50% or more moisture by weight. With this moisture content, molds will grow on the

surface of the shells and inside on the nutmeats. By circulating warm air over and through the nuts, or by drying them in the sun, the moisture content is usually reduced to less than 10% by weight. The shell is porous. With this low moisture content, molds cannot grow. Refrigeration further retains the good quality of nuts and nutmeats by:

1. Inhibiting color changes
2. Retarding the development of rancidity
3. Delaying staleness
4. Preventing insect growth."

IX. RECOMMENDATIONS ON BEST MEANS OF FOOD QUALITY MAINTENANCE

A. Through Dating/Coding

Open dating of individual packages of shelled and unshelled nuts will not assure the consumer of always getting the best quality nuts because shelf life is dependent on temperature and relative humidity conditions prevailing during storage, transportation, and display.

The open dating, in English, of all shipping cases and overwraps is recommended to encourage rotation of stock.

Date of shelf display stamping of all packages is recommended to encourage stock rotation at retail stores as well as on the consumers' premises.

B. Other Means of Quality Improvement

Nuts should be commercially stored by refrigeration (as near 32°F. as possible), and should be maintained at that temperature for as long as possible before displaying on open shelves. Nuts on display in retail outlets should not lie in warm areas; they should also be protected against direct sunlight or artificial light. Consumers should be encouraged by storage directions on labels to store nuts in the refrigerator.

X. REFERENCES

- (1) Chain Store Age, 1969 Supermarket Sales Manual, Lebhar-Friedman, Inc., New York, N.Y., July 1969.
- (2) American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc., ASHRAE Guide and Data Book, Applications for 1966 and 1967, New York, N.Y., pp. 677 and 678.
- (3) The Refrigeration Research Foundation, Commodity Storage Manual, "Nuts and Nut Meats," Washington, D.C., rev. 1961.
- (4) Rockland, L. B., Swarthout, D. M., and Johnson, R. A., "Studies on English (Persian) Walnuts, Juglans regia, III, "Stabilization of Kernels," Food Technology, Vol. 15, No. 3, 1961, pp. 112-116.

- (5) McGeary, Bernice K., and Smith, Malcolm E., "Nuts, a Shell Game That Pays Off in Good Eating," in Foods for Us All, The Yearbook of Agriculture 1969, U.S. Department of Agriculture, 1969, pp. 196-204.
- (6) U.S. Department of Agriculture, Agricultural Research Service, Composition of Foods, Agriculture Handbook No. 8, Washington, D.C.
- (7) Lee, L. S., Cucullu, A. F., and Goldblatt, L. A., "Appearance and Aflatoxin Content of Raw and Dry Roasted Peanut Kernels," Food Technology, Vol. 22, No. 9, 1968, pp. 1131-1134.
- (8) Goldblatt, L. A., "Aflatoxin and Its Control," Economic Botany, Vol. 22, 1968, pp. 51-62.
- (9) Woodroof, J. G., and Heaton, E. K., Storage of Pecans, Mimeograph Series N.S. 149, Georgia Agricultural Experiment Station, University of Georgia, College of Agriculture, July 1962, pp. 1-4.

DIETETIC AND LOW-CALORIE FOODS

I. INTRODUCTORY REMARKS

The basic food products included in this group are similar to those mentioned under various other types of food except that they are lower in calories. While there are several important ingredient (and processing) details by which these products differ from the conventional items, the overall basic processes of manufacture, packaging, storage, and transportation are similar.

Because the composition and processing of these dietetic and low-calorie foods are basically similar to that of their conventional counterparts, these processes will only be summarized here.

A large portion of these foods are consumed for the purpose of generally restricting caloric intake; others are used because of a medical directive to restrict a basic dietary intake of single food components as sugar (sucrose) and sodium owing to metabolic difficulties of assimilation.

As a result of the recent action taken by the FDA against the unrestricted use of cyclamates in beverages, various industrial changes have been made. These changes and a discussion of the cyclamate situation are not reflected in this report because materials in the files at this writing were terminated before the sudden initial FDA action against cyclamates and its secondary reaction to permit their reintroduction with appropriate label restriction specifications.

Throughout this chapter, instead of using the terms dietary and low calorie repeatedly, the term dietary only shall be used.

II. SUMMARY OF RECOMMENDATIONS (see also section IX)

A. Adoption by the New Jersey Department of Health of the coding recommendations of the FDA Good Manufacturing Practices, Federal Register, April 26, 1969, for processed foods. Disclosure of code meanings by food manufacturers to the New Jersey Department of Health on request by the latter.

B. Adoption of the open date of manufacture labeling for all outer cases/overwraps, etc., to assist in stock rotation.

C. Voluntary coding of all individual containers in such cases/overwraps by the food industry with codes of its own choosing (similar in intent to A. above). Such codes should indicate plant location, date of manufacture of final product in container, shift, production line, and any other aspects of products, at the manufacturer's discretion.

D. Stamping of date of shelf display by retail stores for stock rotation and as a consumer aid in home storage stock rotation.

E. Expansion of instructions for consumers' use and storage to include temperature data.

III. TYPE OF FOOD AND PRODUCT GROUPS

Dietetic and low-calorie foods, by product group, category, and variety

Product group	Percent- age of total sales	Product category	Percent- age of depart- ment sales	Percent- age of total sales	Product variety	Percent- age of depart- ment sales	Percent- age of total sales
Dietetic and low calorie foods	.34	Supplements	28.7	.098			
					Liquid	19.2	.065
					Powdered	7.2	.024
					Other	2.3	.009
					(Cookies, soups, etc.)		
						<u>28.7</u>	<u>.098</u>
		Fruit	21.7	.074			
		Artificial sweeteners	11.5	.039			
		Sauces & dressings	6.9	.023			
		Candy & gum	6.6	.022			
		Juices	5.6	.019			
		Spreads & syrops	4.5	.015			
		Dinners (not supplements)	3.6	.012			
		Desserts & toppings	3.6	.012			
		Cookies & crackers	2.2	.007			
		Vegetables	1.9	.006			
		Salt sub- stitutes	1.4	.005			
		Fish & meats	1.0	.003			
		All other	.8	.003			
	<u>.34</u>		<u>100.0</u>	<u>0.338</u>			

Source: Chain Store Age, 1969 Supermarket Sales Manual (1), Lebhar-Friedman, Inc., New York, N.Y., July 1969. Used with permission of the publisher.

IV. TYPE OF PROCESSING AND PRESERVATION

Liquid diet supplements require processing and heat sterilization similar to conventional nonacid canned goods. Storage is at room temperature. Formulations are based on choices made by individual manufacturers to provide for a restricted amount of calories per unit and to supply a balanced assortment of other nutritional requirements.

The powdered diet supplements are dry mixes designed to yield nutritional results on reconstitution which are equivalent to the foregoing liquid diet supplement products. These products require packaging protection similar to conventional dried products mentioned elsewhere.

Dietary cookies resemble conventional cookies except that they normally contain artificial sweeteners instead of sugar. Dietary fruits are usually canned by the same processes as regular fruits except that sugar syrups are replaced by solutions of artificial sweeteners.

Dietary sauces and dressings vary from regular products by the significant reductions of their oil content, and by added body and consistency agents to give suitable mouth feel and impart rheological properties for clinging to salads. Bodying agents may include gum tragacanth, carrageen, locust bean gum, and carboxymethyl cellulose.

Dietary jams, jellies, and preserves differ from the conventional products in much the same way, i.e., by substituting artificial sweeteners for natural sugars, and also by use of low-methoxyl pectin in addition to some of the vegetable gums. The absence of the high soluble solids content (over 65 percent), owing to the presence of sugars in conventional jellies and preserves, requires greater processing care during heat treatment to assure commercial sterility. Parts 29.4 and 29.5 of the FDA Regulations issued under the Food, Drug, and Cosmetics Act of 1938 contain standards of identity for artificially sweetened jellies and artificially sweetened preserves and jams, respectively.

Dietary frozen or canned dinners are generally not based on synthetic substitutes, but are designed to provide balanced basic nutritional need without high-calorie sauces and similar flavorful but nonessential components. Canning is the same for these as for any other conventional product.

Bread with no salt added is made for low-sodium diets and is called "salt free" or preferably "no salt added" bread. It is usually made with a texture resembling that of regular white bread.

The foregoing descriptions serve as examples of the entire line of dietetic and low-calorie foods.

There are also FDA regulations (standards of identity) specifically applicable to various artificially sweetened juices promulgated under the Food, Drug, and Cosmetic Act. Other regulations have been proposed by FDA establishing definitions and standards of identity for dietary supplements

of vitamins and minerals and for vitamin and mineral-fortified foods with the intent of revising the regulations for food for special dietary uses. These have been delayed, however, because of the many industry objections raised to the proposals.

V. QUALITY CHARACTERISTICS

The requirements of these products concerning color, flavor, and texture are basically the same as those of their conventional counterparts. In many instances, the quality features are very similar; in others, there are noticeable differences, but these are not sufficiently great to make the products unacceptable.

The liquid and dry mix supplements are expected to have pleasant flavor, body, and mouth feel.

VI. PROCESSING AND STORAGE QUALITY LOSS FACTORS

Quality losses and stabilities are the same as they are in the equivalent regular products.

VII. PRESENT PRACTICES OF CODE DATING/PUBLIC DATING

A. Voluntary Food Industry Code Dating and Monitoring

Company #300FIS codes its products, but gave no further information on coding and monitoring practices.

Company #355FIS codes all packages with year, day of packing, and plant location if packed in multiplant locations. Supplementary information on month, shift, hour, packing line may be coded.

B. Legal or Required Dating

1. Federal--There are no Federal requirements for public dating. The FDA regulations contained in the Federal Register, April 26, 1969, Good Manufacturing Practices, indicate that FDA would like code dating in interstate and intrastate commerce shipments.

2. State and 3. Municipal--There are no distinct State or municipal requirements for dating of dietary foods, with the exception of imitation milk products. However, if regular foods were to have dating requirements, the dietary equivalents would require similar considerations.

4. Foreign--Certain foreign governments require dating of dietary food (see Legal Report, appendix II).

C. How Dating Influences Quality Maintenance: Advantages and Disadvantages of Dating

Open dating will not assure the consumer of always getting top-quality products because storage stability and shelf life are dependent on choice of raw materials, manufacturing methods, package design and materials, care exercised in quality control, storage and transportation environment, and possible abuse of product owing to excessive temperature or temperature fluctuations. Many dietary products have relatively long storage life, perhaps even longer than regular foods, because some are specially engineered and fabricated. Therefore, selection of a slightly later dated product by the consumer in preference to a slightly older package would not assure the customer of getting any better product, since quality changes are often so slight and subtle that they are virtually nonmeasurable even on the scientific microscale. This practice could lead to rejection of quality merchandise which then would have to be destroyed. Such destruction would be detrimental to the consumer because of resultant higher costs and unavailability of foodstuffs.

VIII. FOOD PRODUCT ITEM LIST

A. Shelf Life--Food Industry Sources (FIS)

<u>Food item</u>	<u>Time*</u>	<u>FIS No.</u>
Chocolate coatings (topping)	6M	630
Dinners, canned beef & chicken	12M	300
Drink beverage mix, dry	9M	30
Fruit drinks, canned	4M at <70°F.	300
Fruits, canned	12M at <70°F.	300
Jellies, in glass	9M at <70°F.	300
Margarine	12M at 40°F.	560
Mayonnaise	3½M	30
Mayonnaise	4M	120
Low-calorie sweeteners	9M	30

M=month.

<u>Food item</u>	<u>Time</u>	<u>FIS No.</u>
Preserves, in glass	9M at < 70°F.	300
Salad dressing	3½M	30
Salad dressing	3M	300
Salad dressing, French	12M	565
Salad dressing, Italian	12M	565
Salad dressing, Russian	12M	565

Company #300FIS states with respect to the above:

"Storage temperatures 20° or more above 60°F. reduce the shelf life of most of our canned products 25-50%. Storage temperatures below 80°F. do not change the nutritive value of our canned products except for vitamin C. No chemical or microbial deterioration will appear in any of our canned foods if the storage temperature does not rise higher than 90°F. Prolonged storage at low temperatures (25°-35°F.) will cause syneresis or weeping in products which contain certain types of starches."

B. Shelf Life--Scientific Sources

N. D. Pintauro (2) advises that low-calorie gelatin dessert mixes have almost as good stability as the conventional mixes, but are just slightly more sensitive to storage time because of the concentrated condition of the acid ingredients owing to the absence of sugars. Under weather conditions of the New Jersey area, they can be stored satisfactorily for 1 year, i.e., through 2 summer periods. In the deep South, they will be durable only through 1 summer, or in some cases possibly through 2 summers, except in the hot and humid areas of the Gulf Coast, where they can only be expected to remain in top condition through 1 summer.

IX. RECOMMENDATIONS ON BEST MEANS OF FOOD QUALITY MAINTENANCE

A. Through Dating/Coding

Open dating of individual packages is not recommended (see section VII, subsection C).

Open dating, in English, of all shipping cases and overwraps is recommended to encourage rotation of stock.

Date of shelf display stamping on all packages is recommended to encourage stock rotation in retail stores as well as in the consumer's home after purchase.

Coding of individual packages to comply with Good Manufacturing Practices, Federal Register, April 26, 1969, is recommended.

B. Other Means of Quality Improvement

Manufacturers should specify any special temperature requirements for storage in their instructions to consumer (see shelf-life data above and time/temperature notations).

X. REFERENCES

- (1) Chain Store Age, 1969 Supermarket Sales Manual, Lebhar-Friedman, Inc., New York, N.Y., July 1969.
- (2) Dr. N. D. Pintauro, Department of Food Science, Rutgers University, personal communication.

DELICATESSEN AND INSTITUTIONAL FOODS 1/INTRODUCTORY REMARKS 2/

The areas of concern in this chapter are "delicatessen" style products and institutional foods, including catering services and vended foods. The foods involved often are packaged foods^{3/} and merit consideration because they are recognized as potential carriers of food-borne illness. In the United States, reported food-borne illnesses are recorded by the National Communicable Disease Center (CDC). Tables 15 and 16 are recalculated condensations of data from CDC publications for 1967, 1968, and 1969. Although these data are the most up-to-date available, they are still incomplete as noted by the CDC (2):

"...As is readily apparent from the line listing of outbreaks, there is considerable variation in the completeness and depth of reports. In 46 percent of the outbreaks, the etiology was not specified or was unconfirmed. Some health authorities are thorough in reporting; others do not report at all. The data are therefore, not representative. Consequently, in our judgment, it is difficult to draw definitive conclusions about patterns of foodborne illnesses from these data. Nevertheless, the predominance of certain etiologies over others and various trends within these etiologies are discernible.

"Food poisoning in the United States is grossly underreported. In England and Wales, where food poisoning surveillance has been well developed, 705 outbreaks of food poisoning were recorded in 1967, whereas only 345 outbreaks of food poisoning were reported to CDC for the same period. The estimated number of outbreaks for the United States

1/ These products are considered "potentially hazardous" foods. Section 1:17 of the Retail Food Establishment Code of New Jersey, 1965 (1) defines potentially hazardous food as follows: "Potentially hazardous food shall mean any perishable food which consists in whole or in part of milk or milk products, eggs, meat, poultry, fish, shellfish, or other ingredients capable of supporting rapid and progressive growth of infectious or toxigenic microorganisms." The survey team is not in total agreement with such a definition and would reword it to read, "Potentially hazardous food shall mean any food capable of supporting growth of infectious or toxigenic microorganisms, or any food containing metallic or pesticide residues toxic to man." The term "perishable food" should be eliminated because it is difficult to define without taking into consideration a great number of factors.

2/ The outline followed throughout this report is not used for this food department.

3/ See N.J. Senate Bill No. 434, introduced February 8, 1968.

Table 15.--Sources of food-borne illness 1/ as percentage of total outbreaks reported, 1967-69

Source	1969	1968	1967
	<u>Percent</u>		
Home	42.3	27.9	22.0
Restaurant	28.0	33.0	28.0
Banquet	NA	10.0	12.0
School	10.3	12.9	17.0
Store	NA	6.8	5.0
Medical institution	NA	2.0	2.6
Other	11.7	7.0	10.5
Unknown	NA	0.4	2.9
Delicatessen	0.2	NA	NA
Cafeteria	1.6	NA	NA
Picnic	0.8	NA	NA
Church	2.2	NA	NA
Camp	2.9	NA	NA
Total percentage	100.0	100.0	100.0
Total outbreaks	(371)	(345)	(204)

NA = Not available.

1/ Food-borne disease is considered synonymous with food poisoning by the CDC and is defined as "...disease caused by ingestion of a pathogenic organism or noxious agent contained in a water or a food vehicle...."

Source: CDC (2).

Table 16.--Source of mishandling of food as percentage of total outbreaks reported, 1967-69

Source	1969	1968	1967
	<u>Percent</u>		
Food processing establishments	8.4	6.2	NA
Food service establishments	30.8	43.8	NA
Homes	12.9	9.2	NA
Unknown	NA	NA	NA
Unspecified	47.9	40.8	NA
Total percentage	100.0	100.0	

NA = Not available.

Source: CDC (2).

proportionate to the population in England and Wales is over 2,800.4/ This figure serves to emphasize the probable scope of involvement of food poisoning in this country and the gross discrepancy between the expected and actual number of foodborne disease outbreaks reported...."

TYPE OF FOOD AND PRODUCT GROUPS AND PRACTICES FOR QUALITY MAINTENANCE

Delicatessen Foods

Delicatessen foods are prepared and sold in neighborhood delicatessen stores, and also are prepared and sold unpackaged and prepackaged in supermarkets. These foods include salads, gelatin desserts, cooked puddings, custards, cheeses, cooked meats, and smoked and cooked fish. Only the first three categories are specifically described here; the discussion of delicatessen foods generally refers to all of them.

Salads, particularly when the pH is below 4.5, are not likely to pose serious health hazards because pathogenic bacteria do not grow to any dangerous extent at that acidity. Some salads, however, which would taste too sour if the pH were lowered to 4.5, can be hazardous to health, especially if kept above refrigeration (38°F.) temperatures before consumption. Some commercial chicken and tuna fish salads are in this category.

Puddings are usually in the nonacid pH range. Pathogenic bacteria may grow in such products, particularly if present originally in the raw materials. Sanitation is a significant factor even when puddings are packaged immediately after final cooking because of potential contamination by employees who are not thoroughly trained in sanitary handling procedures. When puddings are cooked in individual service containers, health hazards are less likely.

A quality loss of aesthetic but not primarily health hazard nature occurs due to mold growth which may develop under favorable moisture conditions (even under refrigeration) inside sealed containers of gelatin desserts. Some operators use preservatives such as sodium benzoate or potassium sorbate to overcome this growth. Preservatives, however, cannot salvage a poor product, nor significantly extend storage life if products are prepared under unsanitary conditions. They may create hazards by preventing the growth of visible molds at the expense of allowing invisible pathogenic bacteria to propagate. They serve only to prolong the storage life of sanitary products.

In localized operations, delicatessen products are generally prepared daily in small quantities so that fresh supplies are assured. Provided they

4/ In a recent article referring to food-borne disease outbreaks in the United Kingdom, the London Sunday Times Magazine (Jan. 31, 1971) stated:

"...these formal food poisoning figures (i.e., United Kingdom) are only the tip of the iceberg. . . . Any doctor will admit that he only goes through the formal procedure of 'reporting' to the Medical Officer of Health when his patient is severely struck down. . . ."

Consequently, even higher numbers than those quoted above might be considered possible in England and Wales.

are adequately refrigerated (38°F. or lower) and made from quality ingredients under sanitary conditions, these products generally do not constitute a health hazard. However, practices such as unsanitary handling of ingredients, use of unsanitary raw ingredients, and particularly reworking of aged displayed products under such conditions can introduce significant numbers of bacteria, some of which may be pathogenic.

Recent merchandising trends illustrate widespread and rapid expansion of delicatessen-style operations into supermarkets, where such food products are sold loose or in prepackaged forms. Potential health hazards in such instances increase because the time between preparation and sale has increased. The time interval increases particularly when foods are prepared in a central commissary location and transported to local outlets. Other risks of hazards to exposure occur during the transportation step. Furthermore, the number of handlings increases, and the handlers may not be as quality or temperature conscious as individual neighborhood retail "deli" owners.

The subject of delicatessen foods and precooked foods requires intensive research to determine the variety of practices currently in use and to enumerate and eliminate possible health hazards. The New Jersey Department of Health should expand its Sanitary Food Programs to include such operations.

Members of the Rutgers survey team have seen food preparation areas equipped with first-class equipment in which an ill-trained operator used his hands instead of a sanitized tool to touch recently sanitized food. Whether done in innocence or ignorance, such simple mistakes are primary causes of food-borne illness, especially if correct temperatures are not kept at both preparation and consumer levels. Many operations which use good equipment, adopt high standards, and conduct exemplary operations commonly exist.

The following steps should be followed in the production of delicatessen foods, whether prepared in large packaged quantities or in small, fast turnover "deli" operations:

- (1) Use of sanitary stainless steel equipment
- (2) Establishment of written procedures for cleaning and sanitizing of equipment
- (3) Use of sanitary processing procedures (including rapid cooking, cooling, and cold storage of products)
- (4) Development and use of ingredient and packaging specifications for raw products
- (5) Establishment of quality control checks by the company or independent testing laboratories.

Also worthy of consideration is a mandatory training program for all food handlers involved in the delicatessen-type of operation. Such programs could be officially established and administered by an agency such as the New Jersey Department of Health. Additional training courses in all retail and food-handling

operations (perhaps with cooperation of trade unions) similar to those designed by the Department of Food Science of Rutgers University for the annual Meat Science Institute Program, or to that used by the New Jersey Department of Health for certification of State food sanitation officers, should be instituted (3).

Financially conceived incentive schemes to benefit both employers and trainees during training programs could be developed. Some foreign countries provide such incentives in food service and related areas by providing tax remissions to employers and employees on costs of training, or provide their own schools to directly institute the training. Training is often coupled in such instances with on-the-job experience and reward incentives to employees who complete courses. Trainees receive lower pay rates than experienced employees, but are given lump cash sums upon certification and course completion, and additional allowances after 6-9 months of actual experience in the trade. These sums may equal the actual pay rates received by trained certified employees. Such courses aid in recruitment of employees, reduce the number of dropouts, and raise sanitary levels in institutional and food-processing plants with resulting consumer benefits by expanding awareness of sanitary requirements.

Institutional Food Services

Catering.--Such services have great, inherent potential health hazards. Improperly and untrained kitchen and service personnel, as well as incorrect temperatures of heating and refrigeration, can be real sources of contamination. Bacteriological contamination in the kitchen may be caused by poor sanitary habits; e.g., using the lavatory and returning to food-handling areas without thoroughly washing hands and exposed skin areas of the arms; failure to cover hair while working; cross-contaminating of cooked foods by using cutting boards that have not been thoroughly cleaned and sanitized after being used for dressing raw chicken. There are many other personal health habits which could pose health hazards by causing contamination of food.

A major weakness of catering institutions lies in the frequent failure to observe the simple food rule to "keep it hot (over 145°F.) or keep it cold (below 40°F.)." ^{5/} Foods cooked in a commissary situation and kept warm (less than 145°F.) versus hot (over 145°F.) in cabinets during transportation can be subject to ideal incubating conditions during transportation and holding prior to serving. Dressed turkeys with undercooked stuffing served at Thanksgiving and Christmas are a noted serious source of potential trouble when incubating conditions prevail, i.e., 40-145°F. Salads for summer gatherings are also a traditional source. Inadequate reheating of leftover foods to less than 145°F. has been the suspected cause of many food-borne disease outbreaks.

Cross contamination (mentioned earlier) may be avoided by distinctly isolating cutting areas and even personnel from each other. Separate cutting boards and utensils for meats, poultry, fish, pork, and vegetables reduce the

^{5/} These temperatures (40-145°F.) differ from those recommended generally, i.e., 45-140°F., on the basis of graphical materials which indicate the need for the extra margin of 5°F. in either direction.

sources of cross contamination caused by equipment. Cross contamination due to personnel moving from one preparation area to another can be more difficult to control.

It should be noted that many operators and fast food outlets give very careful attention to their practices and deliver nonhazardous, clean food to the consumer.

Takeout Trade.--Other sources of hazards are barbecued chickens and prepackaged sandwiches. Such foods constitute carryout and takeout lunch business.

If the chickens are freshly broiled, then kept hot (over 145°F.) and not merely warm, and sold for immediate consumption, there is no reason for alarm. Unfortunately, these conditions are not followed. One chain organization with numerous sales outlets conducts most of its roasting and selling within local shops. It has some sales outlets with no facilities for roasting or other preparations. Consequently, roasted chickens are prepared in one main shop, sometimes without reaching proper internal cooking temperature during peak sales periods. The roasted chickens are packed in large, uninsulated, flat boxes (sometimes handled with tongs), covered, and brought to the other nonfacility sales outlets by a private car, taxicab, or even delivery bicycle. By the time the chickens arrive at the other sales outlet, their temperatures are below 145°F. At such time, the whole load is put into heated sales display cases designed only to maintain heat, but not to reheat partially cooled products. Cases may be so fully loaded with the newly delivered broilers that the cover doors cannot be completely closed, allowing more heat to escape. As part of the sales procedure, the customer may choose a broiler, have it weighed, reject it because of size, and select another. Each broiler is placed on the same scale. Finally, after the selection is made, the broiler is put into a foil-lined bag and taken home, involving a trip of unknown length in any and all seasons. The possibility of illness caused by such operations is high. While normally the quick turnover sale of prebroiled or barbecued chickens involves no hazard, situations such as the foregoing should be sought out.

The growth in popularity of in-store barbecues and rotisseries gives rise to concern about sanitation, temperature attainment and maintenance, and the carryover of unsold stock. Dating of laminated foil bags with time and day of cooking, while seemingly practical, seems too subject to arbitrary revision and alteration by the vendor. Local municipal control by public health officials could be effective provided such officials have sufficient manpower to patrol such operations. As in the case of AFDOUS (Association of Food and Drug Officials of the United States) standards for frozen foods (4), the establishment by the New Jersey Department of Health of regulations for such matters seems necessary as a starting point to controlling in-store cooked foods. Special training courses should be established. The development of temperature/time tell-tale devices to show cooking temperatures would also be beneficial, as would notices describing correct temperatures for consumer information, and large dial thermometers on cabinets.

The State of New Jersey should establish standards and a program to require State approval of equipment and premises similar to that existing in

the New York City Health Codes. Particular emphasis should be given to excluding any raw materials, personnel, practices, or equipment which are likely to promote or introduce health hazards. There is sufficient appropriate equipment available, e.g., National Sanitary Foundation-approved equipment.

The survey team recommends the establishment of codes of mandatory operating, cleaning, and sanitary rules for personnel and equipment. This code, which should be a required instructional program for all food-handling employees--management and workers--could be enforced by the New Jersey Department of Health and its local agencies. Most food factories have mandatory or voluntary annual physical examinations for food-handling employees; yet, these examinations are very rare among delicatessen and catering services where they should be required as common practice. The team strongly suggests that the New Jersey Department of Health legally require the adoption by all local boards of health in New Jersey of the Retail Food Establishment Code of New Jersey (1).

Some of the foregoing matters are complicated and cannot be resolved without extensive research. The need for such research is apparent owing to the increasing use by the consumer of catering services, central commissaries, and food prepared or consumed away from home. The bases of some of the above recommendations are best shown by figures 12 and 13. Figure 12 shows the dependence of microbial growth on temperature and time, and illustrates the wisdom of instructions to keep food hot (145°F.) or cold (40°F.). Figure 13 illustrates how temperature affects the growth of food poisoning and psychrophilic organisms.

Vended Foods.--Food vending from machines can be considered another branch of institutional food services.

Recommendations on Delicatessen and Institutional Foods

Some recommendations were included in the foregoing text. On dating matters, coding should be considered a necessity for all prepackaged, prepared products of the delicatessen and food service industries. The revised American Meat Institute Sausage Committee Code adopted in August 1970, using 4 digits--first two for month, second two for day, e.g., 0824 for August 24th--would be suitable, or an open date of manufacture, or date of shelf display. Open expiration dating should provide temperature of storage and time.

Products could be marked on one corner with a color code for storage temperature and overprinted with temperature time information, as shown in figure 14.

REFERENCES

- (1) Retail Food Establishment Code of New Jersey, 1965, F-D18, August 1968.
- (2) National Communicable Disease Center, Foodborne Outbreaks Annual Summary 1967, 1968, and 1969, Atlanta, Ga.

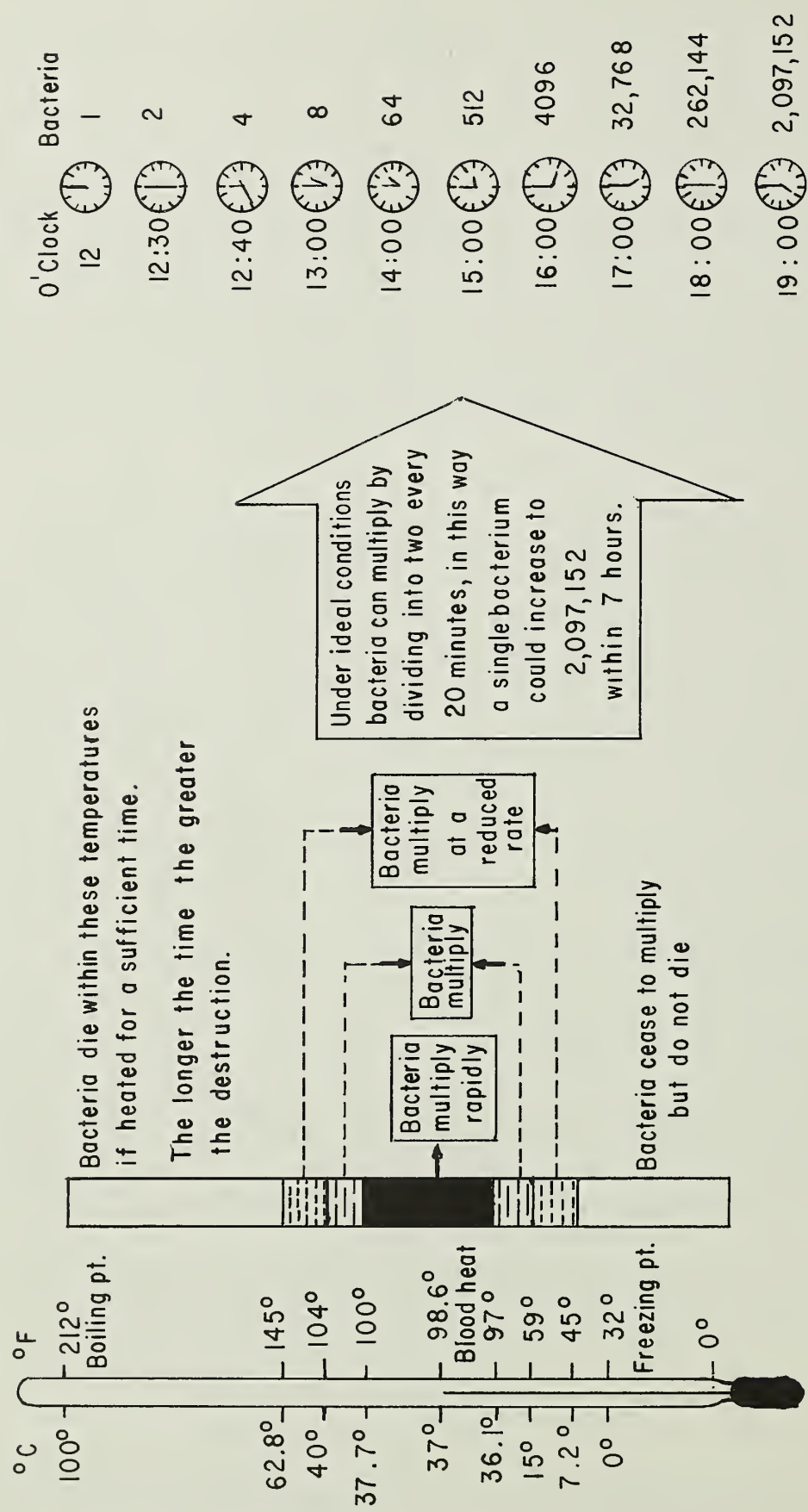


Figure 12.--Dependence of microbial growth to temperature and time parameters.

Source: B. C. Hobbs, Food Poisoning and Food Hygiene, Edward Arnold (Publishers) Ltd., 1968 (5).
 Used with permission of the publisher.

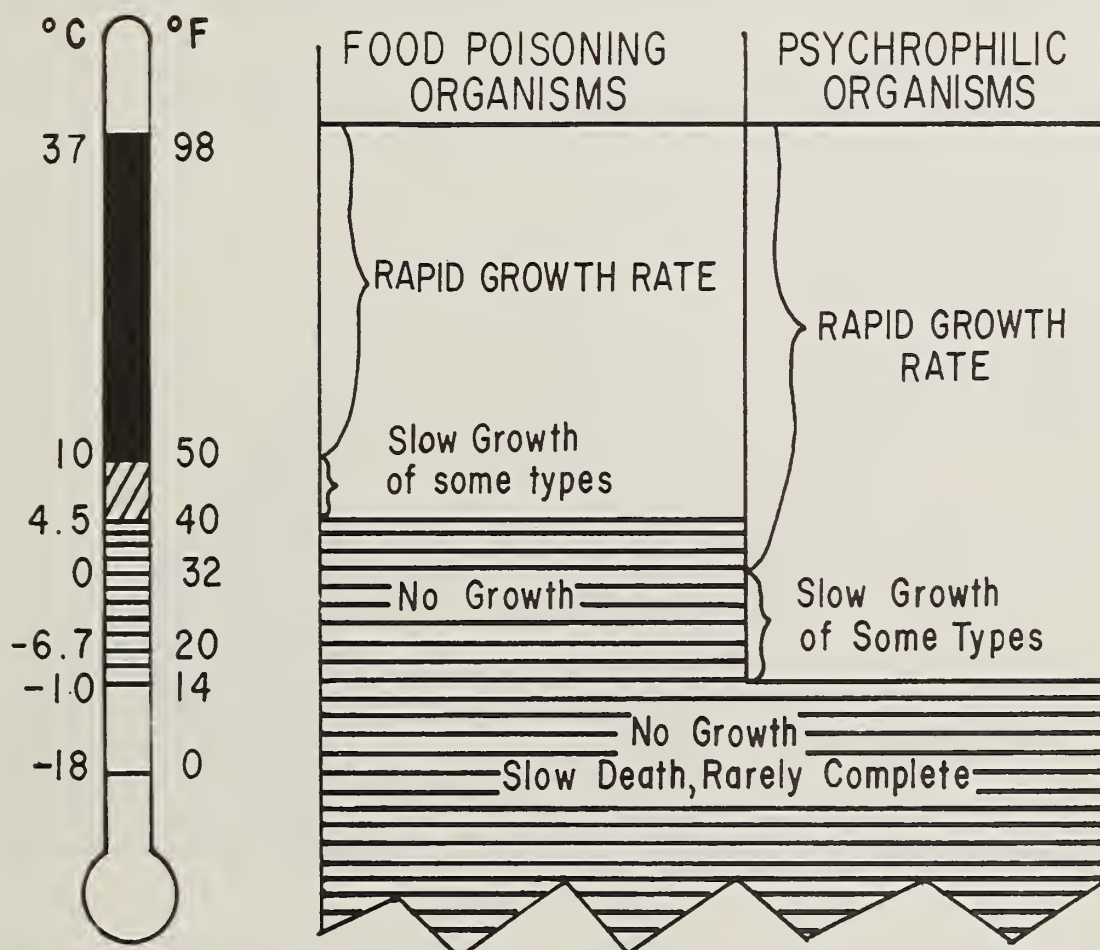


Figure 13.--Relationship of growth of food poisoning and psychrophilic organisms to temperature

Source: Elliot and Michener (6).

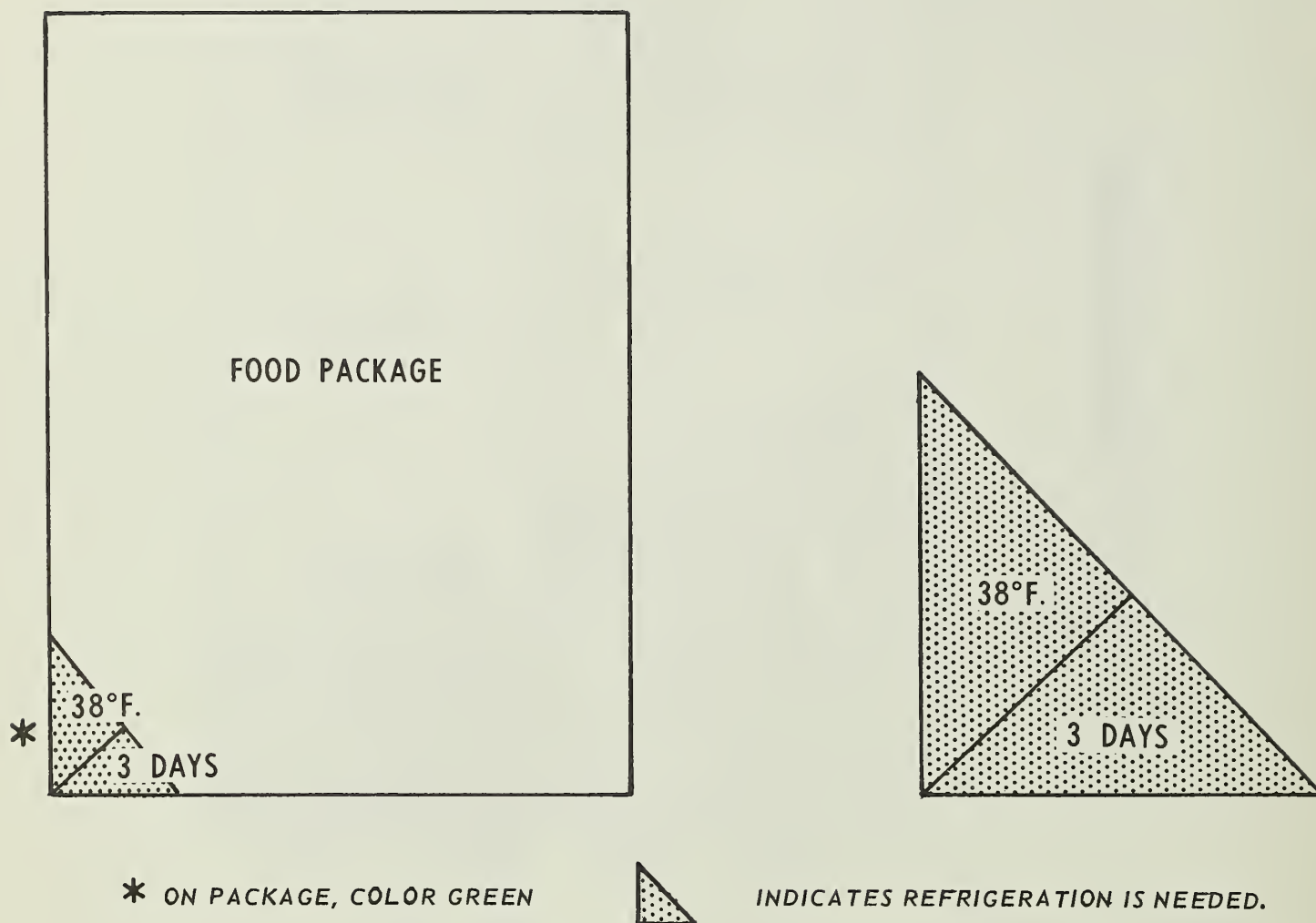


Figure 14.--Food package sample indicating time/temperature requirements to consumer

- (3) New Jersey Department of Health, "Procedures for the Certification of State Food-Service Sanitation Survey Officers and Local Food Service Sanitation Officers."
- (4) Association of Food and Drug Officials of the United States, "AFDOUS Frozen Food Code," Vol. 26, No. 1, January 1962.
- (5) Hobbs, B. C., Food Poisoning and Food Hygiene, 2nd ed,. Edward Arnold (Publishers) Ltd., London, England, 1968.
- (6) Elliot, R. P., and Michener, H. D., "Review of the Microbiology of Frozen Food Quality," U.S. Department of Agriculture, Albany, Calif., 1960.

LEGAL REPORT

INTRODUCTION

This report examines laws and regulations designed to deal with the problem of food deterioration, including economic deterioration (deterioration in color, taste, package, appearance, etc.) and nutritional deterioration.

Examples of such laws are listed and selected models evaluated. Evaluation consists of testing the legitimacy (State and Federal constitutionality) and the workability (cost of enforcement, flexibility, reviewability, etc.) of the laws within the legal process. No attempt is made to judge the wisdom of any model or of any date-labeling or shelf-removal laws generally.

Materials contained in the appendices are presented in the following order: First, a general description is given of the authority of legislatures to enact laws designed to protect and promote the health, safety, and welfare of the people, with an emphasis on food regulatory laws. Second, a survey in abstract form is made of attempts to deal with the problem of food durability both in the United States and elsewhere. Third, representative statutory schemes are evaluated. Fourth, an appendix listing abstracts of laws and citations to their full text, together with a selected annotated bibliography of secondary materials covering the general subject, is given.

Research Methodology

The general subjects of food regulation, date labeling, Federal-State relations in the area of regulation of health-connected practices in the food products industry, and specifically food-labeling laws, were checked in the Rutgers University Law School Library in Newark, the New York University Law School Library, the Columbia University Law School Library, the Food and Agriculture Organization Library of the United Nations, and the Food Law Institute offices in New York City. Listings considered useful were abstracted or copied in their entirety.

The Index to Legal Periodicals, which indexes all legal periodicals published in English-speaking countries, and many published elsewhere, was examined for all listings from 1940 to the present under the following topic headings: Agriculture; Federal-State Relations; Food; Food, Drug, and Cosmetic Laws; Interstate Commerce; and Legislation. Again, all pertinent articles were abstracted. Those of special relevancy were read in full, and their contents, where appropriate, have been incorporated into this report. In addition, all volumes of the Food, Drug, and Cosmetic Law Journal to date were examined, since that journal contains the largest number of articles on the subject at hand; useful articles were noted as above, and their contents incorporated into this report.

The method of collecting and abstracting or excerpting State laws was as follows: the indexes of all State statutory compilations were examined under the following headings: Agriculture (all subheadings); Brands, Labels, and Marks; Cold Storage; Cold Storage Locker Plants; Cold Storage Warehouses; Dairy and Dairy Products; Eggs; Food (all subheadings); Food, Drugs, and Cosmetics; Frozen Food; Frozen Food Locker Plants; Health (all subheadings, cursorily); Ice Cream; Labels; Locker Plants; Milk; Milk Products; Refrigerated Warehouses; Refrigeration; Warehouses; and miscellaneous listings of individual foods. All statutes directly pertaining to date labeling, storage, storage instruction labeling, shelf removal, and related durability controls were gathered, read in full, noted, and excerpted where appropriate. The search of State laws was done in duplicate for all States and in triplicate for those whose indexing systems are the most obscure or least helpful.

Nonstatutory administrative regulations are typically not published in codified or other readily accessible form, if at all, and States' administrative regulations, where mentioned, were obtained usually from the responses to the food stability survey inquiries made by the Rutgers University Department of Food Science, whose efforts were sometimes hampered by the nonresponsiveness of other States' officials.

Foreign laws were obtained by exhausting the catalog, file, and letter of inquiry resources of the Food and Agriculture Organization (United Nations), the above law libraries, the Food Law Institute, and the Rutgers Department of Food Science.

STATE LAW LIMITATIONS ON LEGISLATIVE CONTROL OF DURABILITY

There are no New Jersey cases dealing directly with statutory requirements of production date labeling, shelf expiration date labeling, or shelf removal in the food products industry. The only such statutes enacted in New Jersey apply to the marketing of milk, and the provisions of the milk-marketing statutes which require pasteurization date labeling have not been challenged or interpreted in the New Jersey courts. However, two sources of inference about the permissibility under the New Jersey Constitution of the kinds of laws described above are available. The New Jersey statutes which regulate generally the milk industry have been considered by the New Jersey courts, and those courts have dealt with the subjects of the allowable scope of delegation of powers to administrative agencies and the constitutional requirement that statutes be reasonably related to some valid legislative purpose. The facts of many of the cases in which the latter questions were discussed are more or less analogous to food marketing.

Delegation of Powers

Initially, it should be noted that the New Jersey courts have recognized that when power is to be delegated to an administrative agency for purposes of administering some scheme of regulation enacted under the State's police powers, it is often necessary to establish and define a broad, flexible grant of power. See, e.g., Cammarata v. Essex County Park Commission, 26 N.J. 404, 140 A.2d 397 (1958). Although this liberal attitude often results in leaving a significant amount of discretion in the administrative agency, the courts have upheld

such a delegation where a "sufficiently basic standard and a definite and certain policy and rule of action for the guidance of such agent" are provided. Itzen & Robertson, Inc. v. Board of Health of Oakland, 89 N.J. Super. 61, 75, 105 A.2d 884 (App. Div. 1954).

It has been held that the milk industry is affected with a public interest, and as such is subject to comprehensive regulation of production and marketing. The United States Supreme Court relied at least in part on such a conclusion about the milk industry in New York to sustain regulations of retail prices in Nebbia v. New York, 291 U. S. 502 (1934). The conclusion in that case about the susceptibility of the milk industry, and presumably therefore of all food industries, to comprehensive regulation is even less questionable today. Indeed, the Supreme Court of New Jersey stated in In re Regulation F-22, Office of Milk Industry, 32 N.J. 258, 262, 160 A.2d 627 (1960):

There can be no doubt that the production, sale and delivery of milk are affected with a public interest because of their relation to the health and welfare of the people, and so are proper subjects for legislative regulation. Transportation and distribution are specifically mentioned in the statute and are obviously factors which enter into the overall regulatory problem.

See also National Dairy Products Corp. v. Hoffman, 40 N.J. 475, 487, 193 A.2d 195 (1963).

Once it has been decided that a particular kind of activity--for example, the marketing of food products--is subject to a State's plenary power to regulate in the interest of the public's health, safety, or welfare, it remains to be decided what is required in the delegation to prevent it from being a delegation of legislative authority. The delegation must not confer unfettered discretion to do whatever the administrative agency considers to be in the public interest in whatever field of activity it considers ought to be regulated. The delegation would then be conferring on the agency those very powers which the legislature is constitutionally ordered to exercise. Rather the delegation must be to administer a legislative policy which is defined in the statute.

As set forth above, the basic rule for testing whether a delegation of authority to an administrative agency is a valid one is that "the statute establish a sufficient basic standard--a definite and certain policy and rule of action for the guidance of the agency created to administer the law." State Board of Milk Control v. Newark Milk Co., 118 N.J. Eq. 504, 522, 179 A. 116 (E. & A. 1935). Of course, the described rule does not begin to tell how cases should be decided, nor does it really provide a workable test for determining whether a policy is "definite and certain" enough to satisfy the rule, or whether the "rule of action" sufficiently circumscribes the agency's discretion to render the decisions it arrives at administrative and not legislative decisions. The result of the vagueness of the rule itself has been that courts have been willing to consider the statute in the light of its context and its apparent objectives, in order to ascertain what the policy and rule of application of the statute are. See In re Berardi, 23 N.J. 485, 129 A.2d 705 (1957); In re Bernaducci, 85 N.J. Super. 152, 204 A.2d 209 (App. Div. 1964); Cammarata v. Essex County Park Commission, supra at 411. In practice, this means that the courts will look at the statute, then at the action taken by the administrative agency. If the action seems to have been arguably contemplated by the

statutory purpose, then the standards set forth in the statute will be held to be sufficiently definite to guide the agency in making decisions, even though those particular decisions look to laymen as though they involve policy rather than simple ministerial application of policy. To paraphrase the cases, a broader construction is usually given to police power statutes as a result of considering the apparent legislative intent or design. See In re Port Murray Dairy Co., 6 N.J. Super. 285, 71 A.2d 208 (App. Div. 1950). And the courts permit broad, permissive construction of such statutes as a result of what they like to call a realistic appraisal of the broad problem area to be regulated under the police power. As said in Schmidt v. Board of Adjustment of Newark, 9 N.J. 405, 414, 188 A.2d 607 (1952):

The police authority does not lend itself to expression in terms of a definite formula that will automatically resolve every case, for its quality and scope are commensurate with the public exigencies arising from ever-changing social and economic conditions.

In short, if the subject matter of the statute seems to the court to be appropriate, because of a need for flexibility or expertise or whatever other reason, for administration or enforcement by an administrative agency, then the statute which delegates the regulatory power to the agency will be held to be valid, and the only exceptions will be in those few cases where the statute provides virtually no policy guidelines. No case recent enough to deserve continued respect and the status of viable precedent has been located which has declared invalid a legislative delegation of power to an administrative agency on the sole ground that the delegation is too broad or vague; presumably the Legislature of New Jersey frames policy statements clearly enough to avoid judicial suspicion.

Once the statute delegating power to the agency has been found to be valid on its face, any regulations of general application issued by an agency are presumed to be valid in turn if they are reasonably related to the delegated power. Sherry v. Schomp, 31 N.J. Super. 267, 106 A.2d 350 (App. Div. 1954). In Welsh Farms, Inc. v. Bergsma, 16 N.J. Super. 295, 306, 184 A.2d 631 (App. Div. 1951), the court discussed the milk regulations issued by the State Commissioner of Health:

Reasonable regulations designed to secure the cleanliness, wholesomeness and purity of milk have been judicially sustained with conspicuous unanimity but the regulation must be reasonable and possess a recognizable adaptation to the object sought to be accomplished by it.

This rule seems to say that a regulation will be sustained unless it is so fantastic that no reasonable man would think it has any tendency to accomplish what the legislature seemed to have in mind as an ultimate goal. It would be hard to imagine a modern legislature failing to meet this test.

As distinguished from rules and regulations of general application, specific orders issued directing some individual to do or not do something, or imposing some status on an individual or his property which has legal consequences, must be supported by a finding of fact or an explanation of the basis for

the decision. See, e.g., Talocci v. Strelecki, 93 N.J. Super. 567, 226, A.2d 632 (App. Div. 1967). The typical explanation of the requirement is that there be "substantial evidence" in the record to support the finding of the administrative agency or the order which is based upon the finding.

If these basic rules are applied to the problem at hand, it is fairly clear that a statute which delegated to an administrative agency the task of determining which of the food products marketed in New Jersey are subject to some kind of deterioration through the passage of time, and then determining what period of time should be allowed for the marketing of the product after production, and then determining whether and how that period ought to be communicated to the consumer or used to limit the allowable selling period, would be upheld by the courts of New Jersey at least as against the argument that the statute was an unlawful delegation of legislative authority. Similarly, any regulations concerning manner of labeling or information to be conveyed--including warnings or instructions not to purchase the product after a certain date--would without serious question be upheld. The only plausible point of contention is the determination of the time period, in the case of expiration date labeling or shelf-removal requirements. A person challenging the agency's determination would have the burden of proving the time period determination was arbitrary, capricious, or completely unsupported by experience. He would have to prove, in other words, that no deterioration of any kind had ever taken place or could ever take place in the products of any manufacturer covered by the rule or order. Almost assuredly, "deterioration" here would include consumer appeal or purely economic deterioration--for example, fading or crumpling of even the package. It seems unlikely that any time period established by an agency after even a cursory examination of food products being displayed for sale would be successfully challenged, at least on this basis.

The courts of New Jersey should not be expected to follow the reasoning of the Supreme Court of Nebraska, which outlawed milk date labeling in Lincoln Dairy Co. v. Finigan, 170 Neb. 777, 104 N.W. 2d 227 (1960). One of the reasons for the decision was that the statute made it a crime to sell milk in contravention of the orders of the agency, and all crimes in Nebraska must be statutory. Since the statute itself did not impose the requirement, the definition of the crime lay outside the statute, contrary to the constitutional statutory crime requirement. There is no similar requirement in New Jersey.

Substantive Due Process

The requirement that all legislation satisfy substantive due process (here, as required by what might be called an unwritten rule of the Constitution of New Jersey) means simply that the statute must have a reasonable relationship to whatever valid legislative objective is sought to be attained by the statute. The health and economic well-being of the consuming public is, beyond question, a valid legislative objective. If that conclusion is assumed, then as stated in a landmark Federal case dealing with the same general subject, due process requires "only that the law shall not be unreasonable, arbitrary, or capricious, and that the means selected shall have a real and substantial relation to the object sought to be obtained." Nebbia v. New York, *supra*, at 525. For somewhat similar statement of the law in New Jersey, see Jones v. Haridor Realty Corp., 37 N.J. 384, 181, A.2d 481 (1962); Katobimar Realty Corp. v. Webster, 20 N.J. 114, 118 A.2d 824 (1955).

The New Jersey Supreme Court has upheld milk price-fixing orders of the administrator because the "business of producing and distributing milk is affected with public interest and . . . price-fixing orders, like other regulations in the field, are lawful if substantially related to a legitimate end sought to be attained." Abbotts Dairies, Inc. v. Armstrong, 14 N.J. 319, 330, 102 A.2d 920 (1944). The relationship between price fixing and the health of the consuming public lay in the connection between a healthy dairy industry, which would result from price fixing, and a readily available supply of milk. Clearly, this relationship was based on speculation, since there has never been a demonstration of the truth of the proposition that there is a correlation between a rich (healthy) dairy industry and the quantity or quality of the domestic milk supply. A statute which is more directly related to the health of well-being of the consuming public, which we assume here date-labeling or shelf-removal legislation in theory would be, should be even more clearly sustainable, unless there were some countervailing reason for invalidating it.

Statutes which purport to be directed to a pursuit of health, safety, or welfare may be invalidated if a court is willing to conclude that the purported objective is really a sham for some objective which is not itself sustainable. For instance, it has been said by a New Jersey appellate court that legislation which purports to be in pursuit of public health may not be used to erect protective barriers around the dairy industry in New Jersey if it in fact bears no relationship to public health. See Welsh Farms, Inc. v. Bergsma, *supra*, at 303. It is difficult to distinguish this statement of the applicable rule from others which seem to suggest that a purely economic regulation would be sustainable if it tends to insure the health of an industry vital to the health of the public. Apparently, as it is suggested may be the practice, the court differentiated between those statutes which are honest attempts to reach a legitimate objective, even though they seem somewhat attenuated from the objective, and those statutes which are merely disguised as reaching toward some valid objective, while actually being designed to achieve some unlawful objective. Any date-labeling or shelf-removal law would clearly fall into the former category, and therefore be sustainable against attack on this ground.

Perhaps the most thorough statement of the dimensions of the substantive due process requirement in New Jersey is found in Reingold v. Harper, 6 N.J. 182 (1951). In that case, the plaintiff was attacking a regulatory statute on the basis that his own safeguards were adequate to protect the public and that the statutory requirements were not reasonably related to the public health and safety and therefore constituted an invasion of the right of property owners to do with their property as they wish.

The New Jersey Supreme Court stated the general rule thus:

It is essential that there be a substantial relation between the protection of the common welfare in the area of action within the reach of police power; and also that the means be reasonable and appropriate to that end.

6 N. J. at 191-92.

Although the quoted passage seems to establish rather strict limitations on the power of the legislature to regulate activity which is within its general power to reach, the court later described as follows the quantum of proof which must be shown of a relationship between the public health and safety and the statutory scheme:

Where the end is one to which legislative power may properly be directed, it is enough "if it can be seen that in any degree, or under any reasonably conceivable circumstances, there is an actual relation between the means and the end.

6 N.J. at 194, citing Stephensen v. Binford, 287 U.S. 251 (1932).

In case there remained any doubt about the apparent declaration that the test is whether circumstances which would support the legislation must only be reasonably conceivable, rather than actually demonstrated to exist, the court said at pages 195-196:

The Legislature had before it a substantial showing of danger in the self-service method; and the court cannot substitute its own discretion for that of the lawmaking body, even though there be a difference of opinion as to the need and propriety of the means devised to serve the need. The constitutional function of judicial review does not include supervision of the legislative judgment within the lawmaking body's exclusive field of action.

. . .

Factual support for the legislative judgment is to be presumed. Barring a showing contra, the assumption is that the measure rests upon some rational basis within the knowledge and experience of the Legislature.

The court here cited in support of its statement Metropolitan Casualty Insurance Co. v. Brownell, 294 U.S. 580 (1935); United States v. Carolene Products Co., 304 U.S. 145 (1939); and South Carolina State Highway Department v. Barnwell Brothers, 303 U.S. 177 (1939), the last two of which are considered classic statements of the Federal due process rule.

These statements by the courts of New Jersey of the due process requirement are diametrically opposed to similar statements by the one court which has struck down date-labeling requirements as being outside the power of the legislature to enact. In Lincoln Dairy Co. v. Finigan, *supra*, the Supreme Court of Nebraska declared that the legislature could impose no requirements on milk sellers beyond a demand that whatever milk they sell be wholesome. Since wholesome milk which did not have on it the date of pasteurization could not legally be sold, the statute and regulation which outlawed such sales were struck down as exceeding the legislative power. The question in New Jersey would be whether such regulations tend to increase the likelihood that consumers will benefit in some fashion from the regulation. The New Jersey courts would not take upon themselves the task of making the value choice which results in confining the legislature to wholesomeness, nor of making the enforcement choice of permitting no prophylactic or preventive regulations such as date labeling.

Substantive Due Process

One landmark statement of the Federal requirement that all statutes bear some reasonable relationship to a valid legislative purpose--the so-called substantive due process requirement--appears in Williamson v. Lee Optical Co., 348 U.S. 483 (1955), which affirmed a State prohibition against fitting optical lenses to the face or duplicating lenses except on the prescription of a licensed Ophthalmologist or Doctor of Optometry:

The Oklahoma law may exact a needless, wasteful requirement in many cases. But it is for the legislature, not the courts, to balance the advantages and disadvantages of the new requirement. It appears that in many cases the optician can easily supply the new frames or new lenses without reference to the old written prescription. It also appears that many written prescriptions contain no directive data in regard to fitting spectacles to the face. But in some cases the directions contained in the prescription are essential if the glasses are to be fitted so as to be corrected. . . . The legislature might have concluded that the frequency of decisions when a prescription is necessary was sufficient to justify this regulation of the fitting of eyeglasses.

348 U.S. at 487.

The day is gone when this Court uses the due process clause of the Fourteenth Amendment to strike down state laws regulatory of business and industrial conditions, because they may be unwise, improvident, or out of harmony with a particular school of thought.

348 U.S. at 488.

The problem of legislative classification is a perennial one, admitting of no doctrinaire definition. Evils in the same field may be of different dimensions and proportions, requiring different remedies. Or so the legislature may think . . . or the reform may take one step at a time, addressing itself to the phase of the problem which seems most acute to the legislative mind.

What Williamson v. Lee Optical Co., which still accurately describes the very broad power which legislatures have to regulate commercial activity in the interests of health, safety, and welfare, really seems to be saying is this: if the statute's regulatory scheme does in fact protect the public against what the legislature considers to be a harmful condition, it does not matter that it unnecessarily restricts a whole range of activity which predictably does not create the harmful condition. Furthermore, the legislature does not have to attempt to prevent or regulate all activity which leads to the same or a similarly harmful condition--i.e., it may regulate limited, only slightly harmful activity and leave unregulated related widespread, very harmful activity. For example, a legislature might validly regulate one cause of food perishability, even though it is a relatively minor factor contributing

to perishability, while leaving unregulated all other factors. Even though it may be evident to all observers that it would not be wise to regulate one without regulating the other factor, it would nevertheless not be in violation of the due process clause of the Fourteenth Amendment.

The Supreme Court of the United States had not since 1937, to our knowledge, ruled invalid solely on the ground that its substance violated the due process clause any State statute which regulated commercial activity. The possibility that a statute regulating commercial activity might substantially be beyond the power of the legislative barrier has not been seriously discussed by the Court in any published opinions since 1948, when the Federal statute creating the Tennessee Valley Authority was challenged. It is clear beyond question that any State statutes requiring date labeling, whether coded or not, or requiring removal from shelves where displayed for sale after a certain length of time, or prohibiting sale after a certain length of time, would not be invalidated as being in violation of the due process clause, unless the challenger could show beyond doubt that no nutritional, economic, or psychological deterioration had ever occurred or could ever occur in any sample of the regulated food within the stipulated time. It would not be sufficient to show that most of the time the regulated food packed by the company attacking the law will remain substantially the same and that no effects harmful to health will occur in virtually all the samples until a greater time has elapsed. Nor would it be sufficient to show that elapse of time after processing or packaging is only one and a very minor factor which determines deterioration.

Preemption of a Field of Regulation by Federal Law.

The Supremacy Clause, Article VI of the United States Constitution, provides that Federal laws validly enacted and within the power of Congress to enact are the supreme law of the land and that State statutory standards are therefore superseded by Federal standards to the extent that displacement is required to effectuate the purpose of Congress. In the area of interstate commerce, substantive legislation enacted by Congress in the exercise of its power under the commerce clause may be found to preempt or occupy the field and thereby displace the State power to deal with some or all aspects of a particular kind of commercial activity.

The Federal Food, Drug, and Cosmetic Act does not by its terms specifically preempt all State laws which regulate the same subject, and the preemption clause of the Fair Packaging and Labeling Act (Section 12) applies only to requirements for net quantity labels. See Atlantic Ocean Products, Inc. v. Walter D. Leth, 292 F. Supp. 615 (1968). And as was said in Florida Line and Avocado Growers, Inc. v. Paul, 373 U.S. 132 (1963), Federal regulation of a field of commerce should not be deemed preemptive of State regulatory power in the absence of persuasive reasons either that the nature of the regulated subject matter permits no other conclusion, or that the Congress has unmistakably so declared. See also Huron Cement Co. v. Detroit, 362 U.S. 440 (1960). Clearly Congress has not in so many words declared this area of food legislation preempted, except in the case of meat packed in federally inspected packing plants, which is discussed below, so we must determine whether the nature of the regulated subject matter leads to preemption by necessity.

The question at hand may be restated: May a State constitutionally reject, because they are not labeled in accordance with State law, commodities which a Federal authority has certified to be marketable? The answer, or test, is that it depends on whether the State regulation "stands as an obstacle to the accomplishment and execution of the full purposes and objectives of Congress." Hines v. Davidowitz, 312 U.S. 52, 67. If it is assumed that the State is going to impose higher standards of "quality" on foodstuffs than those promulgated by the Federal government, then with some qualifications it can be said that with respect to the doctrine of preemption, it appears that this can be done. The States can exclude nonconforming foods without placing "obstacles" before the Federal statutes' purposes and objectives.

In Borden Co. v. Liddy, 200 F. Supp. 221 (1961), set aside and appeal dismissed, 309 F.2d 871, cert. denied 372 U.S. 953, where a 10-percent minimum fat content in ice cream was imposed by Federal law and a 12-percent minimum imposed by Iowa State Law. It was held that Iowa could impose a higher standard than that imposed by Federal regulation. Congress did not preempt the whole field; it only established minimum permissible fat content levels. In Swift & Co. v. Wickham, 364 F.2d 241 (1966) cert. denied 385 U.S. 1036, similar reasoning was applied. Federal law required a label with only the net weight of the turkey including the stuffing, whereas New York law imposed the additional requirement of net weight without the stuffing. It was held that New York could require this additional standard, since Congress did not preempt the entire field of packaged turkey labeling. There was no showing of a Congressional intent to prohibit more exhaustive labeling provisions or that there was any need for a uniform national standard.

In Cloverleaf Butter Co. v. Paterson, 315 U.S. 148, 162 (1942), it was said that a State may, in the absence of an express contrary command of Congress, confiscate or exclude from the market foods which conformed to all the Federal processing standards "because of a higher standard demanded by a State for its consumers."

Federal regulation by means of minimum standards of picking, processing, and transportation of agricultural commodities, however comprehensive for those purposes that regulation may be, does not of itself import displacement of State control over the distribution and retail sales of those commodities in the interests of the consumers of the commodities within the State. Florida Avocado Growers, supra, at 145.

The general conclusion that can be drawn from the cases discussed above is that if Congress has not explicitly prohibited States from regulating specific areas of commerce, the States are free to enact regulations imposing requirements more stringent than those promulgated by Congress or Federal officials without violating the injunction of the Supremacy Clause. And on the question of whether Congress has specifically prohibited State regulation, there shall be no Federal displacement "unless that was the clear and manifest purpose of Congress." Rice v. Santa Fe Elevator Corp., 331 U.S. 218, 230.

The question of "uniformity" may be raised in relation to the exception to the State regulatory power--that Federal regulation will be deemed pre-emptive when the nature of the subject matter permits no other conclusion.

This is true when, for example, the subject by its very nature can admit only of national supervision, Cooley v. Board of Port Wardens, 12 How. 229, 319-320 (1851) (interstate commerce on the waterways, and State interference with Federal design), or, when the subject-matter requires exclusive Federal regulation to achieve a uniformity vital to some specifically protected national interests, San Diego Building Trades Council v. Jarmon, 359 U.S. 236, 241-244 (1969). (National Labor Relations Board rules must be preemptive of State rules to apply uniformly to national labor unions.)

Turning to the question at hand, supervision of preparation of foods for market has always been considered a matter of peculiarly local concern. Florida Avocado Growers, supra, at 144. There seems no compelling national reason for uniformity in food legislation of this kind, so it seems doubtful that Congress will be held to have preempted the field out of necessity for national uniformity.

The most cogent argument which can be made on behalf of the proposition that Congress has preempted the field is based upon the dissent in Florida Avocado Growers, supra. It could be argued that since Federal regulations insure the protection of consumers, State laws will change the standard by providing that products be dated can only be seen to supplant and not supplement the Federal regulations. The effect would be to impose conflicting, rather than supplemental, State requirements. It all depends on what the "field" is defined to be. In light of the cases cited, it is believed that the Congressional mandate would be narrowly limited unless specific proof of legislative intent to the contrary is offered.

In sum, the current state of the law of preemption appears to be that States may impose a more stringent standard than that of the Federal Government, if Congress has not prohibited such laws. They may do so when they act in the interests of the public health and welfare, and when they do not act arbitrarily.

One Federal statute clearly prohibits States from enforcing any labeling requirements more stringent than those imposed by Federal law. The Federal Meat Inspection Act, as amended by the Wholesome Meat Act of 1967, 21 U.S.C. 601 (Supp. IV, 1967), provides in section 678 that States may not impose "marking, labeling, packaging, or ingredients requirements in addition to, or different than, those made under this chapter. . . ." The act does not require any date labeling so any labeling requirements discussed in this report could not be imposed on meat packaged under Government inspection. The Federal statute does not, however, apply to meat packaged by (a) intrastate processors not subject to the jurisdiction of the act because they are not in interstate commerce, or (b) retailers who purchase meat from Government-inspected plants and then re-package in consumer packages. A State statute could, therefore, validly be applied to those two classes of packages without interfering with the Federal regulation. Because Congress has specifically prohibited one kind of State statute in the Federal statute, presumably courts could not infer that Congress intended to "occupy the field" of meat package regulation as far as the constitutional power of Congress to regulate commerce extends (which would undoubtedly extend beyond the present coverage of the act; see Wickard v. Filburn, 317 U.S. 111 (1942)).

Rather, Congress had the opportunity to exclude State regulation of meat packaging and chose only to prohibit that which would be different from the Federal statute in its requirements. The most reasonable inference about congressional intent would be that Congress intended to leave the field to the States.

Burden on Interstate Commerce

Most of the cases which might be thought to involve problems of both the possibility of a burden on interstate commerce and Federal preemption of a field of regulation are decided on the basis of the former, and the question of preemption is rarely reached. The Federal power to regulate commerce is derived from the Commerce Clause, Article I, Section 8 of the United States Constitution: "The Congress shall have power . . . to regulate commerce with foreign nations, and among the several States, and with the Indian tribes." This power has been relied upon to sustain a wide range of substantive Federal legislation only peripherally concerned with interstate commerce as such. The Supreme Court has held, for example, that wheat which is grown and consumed entirely within one state is regulatable by Congress under the theory that home-grown wheat competes with wheat in interstate commerce. Wickard v. Filburn, 317 U.S. 111 (1942). Moreover, the Commerce Clause does more than simply empower Congress to regulate interstate commerce and to regulate that which affects, directly or indirectly, the nature, quality, or amount of interstate commerce. The clause is also interpreted to mean that individual States may not interfere either with Congress's power to regulate or with other States' interest by creating burdens on interstate commerce. Not all that burdens interstate commerce, of course, is held to be an unlawful burden, or States would be powerless to enact almost any regulations for the health, safety, and welfare of their citizens. Courts have had to decide, therefore, whether a statute is designed to protect some interest which is local and legitimate in a way which is not prejudicial to the interests of other States, or whether the statute really protects no valid local interest other than the interest in erecting trade or other barriers against other States. A tariff collected at State lines from out-of-State manufacturers would benefit a local interest, but it would be unlawful because it is applied only against out-of-State persons for no reason except to tax for the benefit of local residents. A duty on a particular kind of fruit from out of State where the duty is used only to pay for an inspection which is also made of local fruit would not be treated the same as the bald tax.

The general rule, then, is as stated in Huron Cement Co. v. Detroit, 362 U.S. 440 (1960), which held that even-handed local regulation to effectuate a legitimate local public interest is valid unless preempted by Federal action, or burdensome on maritime activities or interstate commerce. Assuming that preemption is not the issue, the question then is, if the State law does in fact burden interstate commerce, is the burden justified in terms of the State's inherent power to protect the life, liberty, health, and property of its citizens? See International Packers, Ltd. v. Hughes, 271 F. Supp. 430 (1967).

There is no easy way to discover and describe the manner in which particular fact situations will be treated by courts in determining whether a statute which does burden interstate commerce is justified because of the local interest it protects. A selected group of cases is discussed below, therefore, for the purpose of providing some guidelines to the current state of the law:

Dean Milk Co. v. City of Madison, 340 U.S. 349 (1951). A local ordinance which made it unlawful to sell milk not pasteurized within 5 miles of the city was struck down on the basis that it caused an unfair discrimination against out-of-State milk dealers. The city could, the Court insisted, use nonburdensome alternative methods of insuring a sanitary milk supply.

In Baldwin v. G.A.F. Seelig, Inc., 294 U.S. 511 (1935) a statute fixed the minimum price which a New York milk dealer must pay for milk from out of State. This was declared unconstitutional because it unreasonably favored local producers at the expense of competitors from other States, and economic well-being is not a valid reason for a State to burden interstate commerce. If it were, all provincial protective legislation which erects barriers would have to be upheld.

Polar Co. v. Andrews, 375 U.S. 361 (1964), involved a Florida statute which forced a milk dealer to buy milk exclusively from local producers, and permitted them to buy from out-of-State sources only after local supplies had been exhausted. The statute was struck down as discriminatory, since it clearly favored local producers to the detriment of out-of-State producers.

International Packers Limited v. Hughes, *supra*. The statute at issue provided that imported meat must be labeled as such and if any part of a meat product contained imported meat, it must be so labeled. The statute was held to create a discriminatory burden because the added paperwork, labeling, and bookkeeping merely served to discriminate against imported meat for no valid reason. The court stated that if there was a plausible justification based on quality, then such a regulation would be valid.

Armour & Co. v. Nebraska, 200 F. Supp. 941, (1967), struck down a Nebraska law providing for labeling of imported meat as to country of origin and date of packaging if sterile-packed outside the boundaries of the United States. It was held to discriminate invalidly because it was shown that the purpose was to discourage the importation of goods, and the object was to give the housewife the illusion that the imported meat was not good. Again, no valid purpose was given or asserted for the State action.

Aerated Products Co. of Philadelphia v. Department of Health of New Jersey, 59 F. Supp. 652 (1945). Here an action was brought to enjoin the New Jersey Department of Health from interfering with the plaintiff's product and to have declared invalid a statute which prohibited a product from entering the State. The statute was held to be within the valid police power of the State for the protection of the health and safety of its citizens. Although the law burdened interstate commerce, the effect was incidental and indirect, as in Milk Board of Pennsylvania v. Eisenberg Form Products, 306 U.S. 346 (1939).

Southern Pacific Co. v. Arizona, 325 U.S. 761 (1945). The Arizona train limit law, making it unlawful to operate within the State a passenger train of more than 14 cars or a freight train of more than 70 cars, was held to be invalid as applied to interstate trains. The relative weights of the State and national interests involved do not make inapplicable the rule, generally observed, that the free flow of interstate commerce and its freedom from local restraints in

matters requiring uniformity of regulation are interests safeguarded by the Commerce Clause from State interference. Regulation of trains traveling on rails between States is an obvious instance of the need for uniformity.

Bibb v. Navajo Freight Lines, 359 U.S. 520 (1959). An Illinois statute requiring special mudguards on trucks and trailers (which would be illegal in Arkansas) was declared invalid as applied to interstate motor carriers because it unduly and unreasonably burdened interstate commerce. The reasoning was similar to that in Southern Pacific Co. v. Arizona, supra.

In both of the last two mentioned cases the Court attempted to balance State against national interests, and concluded that if the State interest was significant and compelling, the national interest in uniformity for its own sake might give way.

To conclude, our opinion is as follows with respect to the likelihood that durability laws will be invalidated as violating the Commerce Clause limitations on State power:

- a) Production date labeling laws. Provided a valid State interest is shown, which for this type of label could easily be done, it seems that this type of law would be the most susceptible to challenge as not validly discriminatory. See Armour & Co. v. Nebraska, supra. The argument would be that the consumer would not be better protected by knowing the exact production date, that out-of-State producers would lose out on at least 1 day's traveling time, and that the consumer would probably buy the latest dated item, thereby discriminating against the out-of-State producer for no valid reason. Of course, the first conclusion is the one which is arguable, and therefore a matter for legislative judgment, and the law would be upheld.
- b) Shelf-expiry date labeling and shelf-removal law. We fail to see a distinct difference between this and an efficient shelf-removal law, so we will treat them as one: we believe that this type of law would be easily sustainable in terms of a valid State interest. Clearly a law providing for use of a food before it spoils is within the State-protected health and safety power, and there is no real danger of misleading consumers, and is true of manufacturing date labeling.

ANALYSIS OF REGULATORY MODELS

Actual and hypothetical models of date labeling and related food durability regulatory schemes are discussed below. First, the models are listed and simply described. Then follows a discussion of the similarities and differences, based upon the following variables: enforceability, scope of review by courts or other tribunals, flexibility, and degree of difficulty of administration. No attempt is made to appraise the wisdom of any regulatory methods, and no attempt is made to estimate whether the scheme will work--"work" here being used to mean prevent or inhibit food products which have deteriorated from

being placed in the hands of a consumer who is unaware of the deterioration. These are matters of value judgment in the case of the former and technical knowledge in the case of the latter. No blanket endorsement is given by the Survey for the numerous legal models explored.

The Models

1. Manufacturing Date Labeling (Agency-Uncoded)

Statutory authorization of a designated administrative agency to select foods, using a standard provided in the statute, which are then to be labeled with the date of manufacture or processing or packing, using a method of labeling which is clearly intelligible to the consumer.

2. Expiry Date Labeling (Agency-Uncoded)

Statutory authorization of a designated administrative agency to select foods, using a standard provided in the statute, which are then to be labeled with a date after which the food is not to be consumed, with instructions or a warning to that effect on the container in a form which is clearly intelligible to the consumer.

3. Shelf Removal (Agency-Uncoded)

Statutory authorization of a designated administrative agency to select foods, using a standard provided in the statute, and to establish for each a shelf life after which the food must be removed from display shelves and must not be sold, at least not as fresh or undeteriorated. The requirement that the food be removed from the shelf may or may not be accompanied by a warning or declaration to the consumer that the food should not thereafter be consumed.

4. Manufacturing Date Labeling (Agency-Coded)

Statutory authorization of a designated administrative agency to select foods, using a standard provided in the statute, which are then to be labeled with the date of manufacture or processing or packing, using a code system which is filed with or approved by the administrative agency and which is presumably unintelligible to the consumer. This model is identical in all respects to number (1), except that it requires dating only by code.

5. Expiry Date Labeling (Agency-Coded)

Statutory authorization of a designated administrative agency to select foods, using a standard provided in the statute, which are then to be labeled with a date after which the food is not to be consumed, using a code system which is filed with or approved by the administrative agency and which is presumably unintelligible to the consumer. This model is identical in all respects to number (2), except that it requires dating only in code and includes no warning or instructional message to the consumer.

6. Shelf Removal (Agency-Coded)

Statutory authorization of a designated administrative agency to select foods, using a standard provided in the statute, and to establish for each a shelf life after which the food must be removed from display shelves and must not be sold, at least not as fresh or undeteriorated. If the shelf-life expiry date is to be marked on the container or package or the food itself, it is to be marked in a code filed with or approved by the administrative agency. This model is identical to number (3), except that, in the event shelf life is marked on the container, it is done so in code.

7. Manufacturing Date Labeling (Statute-Uncoded)

This model is identical to number (1) above, except that the foods to be covered are listed in the statute, and no administrative agency is delegated this responsibility.

8. Expiry Date Labeling (Statute-Uncoded)

This model is identical to number (2) above, except that the foods to be covered are listed in the statute, and no administrative agency is delegated this responsibility.

9. Shelf Removal (Statute-Uncoded)

This model is identical to number (3) above, except that the foods to be covered are listed in the statute, and no administrative agency is delegated this responsibility.

10. Manufacturing Date (Statute-Coded)

This model is identical to number (4) above, except that the foods to be covered are listed in the statute, and no administrative agency is delegated this responsibility.

11. Expiry Date Labeling (Statute-Coded)

This model is identical to number (5) above, except that the foods to be covered are listed in the statute, and no administrative agency is delegated this responsibility.

12. Shelf Removal (Statute-Coded)

This model is identical to number (6) above, except that the foods to be covered are listed in the statute, and no administrative agency is delegated this responsibility.

13. Retail Shelving Date Labeling (Agency)

Statutory authorization of a designated administrative agency to select foods and to require retailers selling those foods or offering them for sale to imprint on the label or some other place the date the food was placed on the retailer's shelves for sale.

14. Retail Shelving Date Labeling (Statute)

Same as (13) above, except the foods to be so labeled are listed in the statute.

15. Retail Receipt Date Labeling (Agency)

Statutory authorization of a designated administrative agency to select foods and to require retailers selling those foods or offering them for sale to imprint on the label or some similar place the date the food was received by the retailer into his retail store.

16. Retail Receipt Date Labeling (Statute)

Same as (15) above, except the foods to be so labeled are listed in the statute.

17. Refrigerated Storage and Handling Regulation (Agency)

Statutory authorization of a designated administrative agency to select foods it determines require refrigeration and to establish standards for the storage and handling thereof by persons in the business of storing, handling, and transporting such foods.

18. Refrigerated Storage and Handling Regulation (Statute)

Same as (17) above, except that the list of foods and the storage, handling, and transportation regulations appear in the statute.

19. Consumer Storage Instructions (Agency)

Statutory authorization of a designated administrative agency to select foods and to require manufacturers or processors thereof to provide on the label instructions for the proper storage of the foods by the consumer.

20. Consumer Storage Instructions (Statute)

Same as (19) above, except that the foods to be so labeled are listed in the statute.

21. Appliance Standards and Coordinated Storage Instructions (Agency)

Statutory authorization of a designated administrative agency to require that (a) refrigerating appliances designed for consumer use be marked in some fashion with their storage performance characteristics, and (b) manufacturers or processors of foods requiring refrigeration mark their products with the length of time the food can be safely stored by the consumer in appliances having the above specified performance characteristics.

22. Shipping Carton Manufacturing Date Labeling (Agency)

Statutory authorization of a designated administrative agency to select foods using a standard established in the statute and to require manufacturers or processors of those foods to label the carton in which the foods are shipped with the date of processing.

23. Shipping Carton Manufacturing Date Labeling (Statute)

Same as (21) above, except that no administrative agency is delegated the responsibility of selecting the foods to be labeled, since the details of the scheme are provided in the statute.

Analysis of the Models

1. Manufacturing Date Labeling (Agency-Uncoded)

This model clearly would not offend the Constitution of New Jersey or the Constitution of the United States. Its only requirement is that a date, identified as the date of processing or packaging, be placed on the label. The purchaser is left to draw his own conclusions about the use to be made of the information, and the passage of time imposes no additional requirements on the retailer or the manufacturer; once the package is so labeled, nothing else is required on the part of the processor or retailer. In short, since nothing follows from the mere fact of labeling, it does not impose such an onerous burden on the manufacturer that it should be held by a New Jersey or Federal court to be unreasonable. The Supreme Court of Nebraska would presumably condemn this kind of regulation, since it does impose a requirement on manufacturers which exceeds the wholesomeness of any particular lot of food, and that was the basis of its decision in the case which invalidated the statute establishing milk date labeling in Nebraska. See Lincoln Dairy Co. v. Finigan, 170 Neb. 777, 104 N.W. 2d 227 (1960). It is unlikely, however, that New Jersey courts would follow the reasoning of this case. See the discussion in the section titled "State Law Limitations on Legislative Control of Durability," above. The cost of adding the date of packaging to the label would most probably be assumed by the courts of New Jersey, to be outweighed by the benefit which might flow to the consuming public from knowing the date on which the food was packaged or pasteurized. Evidence that such information is generally not used or is frequently misused would admittedly bear on the wisdom of the statute but would not provide a reason for concluding that the Legislature has no power to choose to have the information provided to the consumer, since the requirement is at least arguably related to the end of protecting consumer health by providing useful information.

The statute is flexible in that it empowers an agency, presumably selected for its expert knowledge of food preservation or its experience in food industry regulation, to choose the foods to be labeled. If a particular food or a whole class of foods seems not to require date labeling, or where the labeling might be unusually or peculiarly misleading to a consumer, the agency could simply decide not to require it to be labeled. An administrative agency is typically better equipped to make such decisions than a legislative body because of its facilities for determining facts quickly and arriving at a quick decision based

on those facts. Legislatures, on the other hand, move rather more slowly through the machinery of committee hearing, committee report, minority report, open debate, amendment, and perhaps a repetition of the whole process in another house.

Processors and packagers of foods chosen for labeling would at least have standing to challenge the classification of foods to be labeled, since they could demonstrate that the labeling added, however little, to their cost of manufacturing. To succeed, however, they would have to demonstrate to a reviewing court that there was no foundation in fact for the classification--in other words, that the classification was arbitrary and capricious. This seems to be an impossible burden, since the determination about the amount of misleading effect which ought to justify an exemption of food arguably similar to that being labeled is a matter of administrative discretion. It requires a weighing of the probable consequences of labeling against those of not labeling, and courts do not substitute their judgment on such questions for that of properly delegated administrative agencies.

The cost and difficulty of enforcing this statutory scheme could be relatively low, since a carefully designed system of random sampling of a manufacturer's production, safeguarded by unannounced testing, could effectively be used to police the scheme. No check of retail outlets would be required, provided the date stamped or printed on the label by the manufacturer were not itself perishable or obliteratable. Spot checking of retail outlets would, of course, tend to encourage them to make sure that they were not purchasing or offering for sale any goods not properly labeled, but checks at the retail outlet would not provide a test of the correctness of any date placed on a label by a manufacturer. Retail outlet testing would yield directly only the information that the food is labeled with some date or is not labeled at all.

Sanctions for selling in the State for retail sale or shipping for retail sale in the State of nonlabeled foods which the agency required to be labeled could either be civil in nature or criminal, although the latter sanctions tend to be slightly imposed or ignored entirely in practice in the case of violations of commercial regulations. Second, any goods so sold or shipped could be seized by administrative or law enforcement officials, apparently without a prior hearing on the question of whether the food is in fact covered by the regulation. Third, sanction could be applied to a retailer who sells or offers for sale goods not labeled as required. If the manufacturer is to be required to label the goods himself before shipment, or if the retailer is to be liable for selling nonlabeled goods (where the manufacturer is required by the statute to do the labeling) then the statute should clearly so state. A court may be disinclined to infer either from a general statute requiring labeling and sanctioning the nonlabeler who sells, since the manufacturer does not normally sell to consumers and the retailer would not be the person expected or required to label with the date of processing or packaging. The problem of properly imprinted but later obliterated labels would also have to be dealt with in the statute, and is likely to occur frequently in practice if this scheme is adopted.

2. Expiry Date Labeling (Agency-Uncoded)

This statutory scheme is somewhat more susceptible to challenge as applied in a particular case than (1) above, since the injury or cost to the manufacturer is more direct and is a result of the establishment of a particular expiry date rather than the generally shared added cost of labeling with the date of manufacture. The injury--of loss of sales after the date of expiry--is here more clearly a result of the way in which the agency exercises its judgment, than simply a result which flows from the existence of some labeling requirement. Food producers who dispute the establishment of an expiry period would not, presumably, have to show that consumers in fact followed the allegedly inappropriately labeled warning; they would have to show only that there was no evidence to support the agency's decision about the length of the permissible selling period--the length of time between date of processing and the date which appears on the label. Again, however, absent a totally irrational finding by the administrative agency for which there is not one supporting instance of deterioration (as defined earlier in this report) in either experience or reasonable hypothesis, the burden is likely to be insurmountable. In short, no arguably reasoned decision by an agency operating under this scheme is likely to be rejected by a reviewing court.

Enforcement of this scheme's expiry date labeling requirements would be similar to that of production date labeling--inspecting at the time and place of packaging, preferably on a random basis.

Liability could be imposed on the processor, as above, but it would be difficult to impose liability on a retailer who sells or offers for sale improperly labeled food unless some control date--such as the date of production--were also placed on the label. Otherwise the seller would have no means of knowing whether the label was proper or was deliberately or accidentally labeled incorrectly so as to create an apparently longer time for sale without likelihood of deterioration. In any event, a processor who intends to extend the approved sale life in violation of the agency's order would undoubtedly use a false manufacturing or packaging date in order to have the label indicate an apparently proper length of time between the labeled manufacturing date and the labeled expiry date. If he is undetected at the point of processing and packaging, he will be undetected thereafter; there will be no way to find out later what the date of manufacture really was.

3. Shelf Removal (Agency-Uncoded)

This scheme would withstand legal attack on constitutional grounds if (2) above would, since it adds nothing to (2) except that it requires the act of shelf removal in addition to expiry dating. The focus of any legal attack would not be on that additional burden, since it may be assumed that the purpose of (2) above is to prevent sale after the expiry date, but rather on the reasonableness of the length of time allowed for sale, which again adds nothing to (2) above. If the length of time allowed for sale is sustainable, then the additional burden of removing the food from the shelves is a matter of legislative judgment, since requiring removal is clearly a reasonable method of achieving the legislative purpose of preventing sale after the established period of time.

The use of an administrative agency makes this scheme as flexible as (1) and (2) above, with respect to ease of change, ease of providing exemptions or exceptions, and efficiency in making determinations of permissible selling period lengths. However, because this scheme gives the agency the power to take a substantially more serious step than (1) and (2)--requiring removal from the shelf and prohibiting sale outright--the all-or-nothing choice implied by the model may seem somewhat inflexible.

There is no reason in the law, however, why an agency could not be authorized to choose from among the three methods of control mentioned thus far--manufacturing date labeling, expiry date labeling, and shelf removal--depending upon its determination of which seems to be appropriate for a particular kind of food. Although this discretion would not be an unlawful delegation of legislative authority, the possibility should be considered that the creation of three classes of controls may well prolong any hearings which would be afforded to food producers or retailers who want to challenge the application to their products of any of the controls. The three classes may in addition tend to cause producers to appeal more often to courts for review. And the use of all three methods of control would of course increase the cost of enforcement, since three kinds of checks would have to be made at the place of production and the place of sale. There would not be three times as much checking, but there would be more checking and it would be more complex.

Enforcement of this shelf removal alone would necessarily be somewhat more difficult and costly than either (1) or (2) above. The essence of the scheme is to force shelf removal, not to provide any information to retail purchasers, and actual removal would have to be enforced by checking at the retail outlet to determine whether outdated foods were in fact removed from the shelf. In addition, however, some date must appear on the label--either expiry date or date of processing or packaging, and that date will have to be checked at the time it is placed on the package to determine whether it is correct. Unless the second step is taken--verifying the date of required removal by checking at the time of packaging--the first will be useless to protect against selling after the lapse of time allowed by the agency regulations. Unscrupulous processors will simply use a false date of packaging to extend the apparently allowable selling period. This scheme is therefore substantially more costly and difficult to enforce than (1) and (2) above because of the need for policing at two different times and places.

Except in the case of food which so clearly deteriorates that it is obviously unfit for human consumption after the expiry date, the question arises of the disposition of the outdated food which will be permitted or required after its removal from the shelf. If the purpose of the statute is to prevent such food from being obtained for human consumption, then the statute ought to require specifically that the food not be sold at reduced prices as being stale or outdated and that the food not be given to any person who intends to consume it (as, for example, outdated food is occasionally donated to charitable organizations). Whether the actual prevention of consumption ought to be the purpose of the statute is not appropriate for discussion here, but perhaps in any event food which has suffered only nonnutritional deterioration should be treated differently from food which has deteriorated in nutritional quality.

The likelihood of substantially increasing the cost and difficulty of administering a multiple disposition requirement must of course be considered as a countervailing factor.

4. Manufacturing Date Labeling (Agency-Coded)

5. Expiry Date Labeling (Agency-Coded)

6. Shelf Removal (Agency-Coded)

Models (4), (5), and (6) are the same by their terms as (1), (2), and (3) above, except that the date information is provided in a code which the administrative agency has approved for the purpose. Clearly, the similarity between these three models and the first three is surface only and is misleading. The purpose of these three models is altogether different from the first three, and the difference is significant for enforcement purposes. The first three models provide intelligible information to the consumer and, with the exception of number (3), which requires actual removal, assumes that the consumer's sense of self-protection will assure that deteriorated food is not purchased. Even number (3), which could be enforced without any action on the part of the consumer, might on the other hand rely on the consumer to police the shelf-removal provision.

Models number (4), (5), and (6), on the other hand, are designed to provide information only to the agency designated to enforce the statute's requirements, and not to provide any information to the consumer. What use may be made of processing date information or shelf expiry date information which is conveyed only to an agency not specifically empowered to make any use of it is not clear, but an agency could be empowered generally to make regulations concerning durability without circumscribing that power with examples or specific limitations. The agency could then, by making use of tests based on the coded manufacturing date labeling, establish shelf-removal or other rules, but this is only an alternative way of reaching the shelf-removal function performed by number (3).

Removing the consumer as a policer of a shelf-removal requirement (number 6) may result in a much higher cost of public enforcement to achieve the same degree of consumer protection, since consumers will not normally know when food is required to be removed from shelves, as would be true if a removal date appeared on the label in noncoded form. The difference in cost and effectiveness of enforcement may be significant, since shelf-removal requirements cannot be effectively enforced by unannounced random sampling, as is true, for example, of manufacturing date labeling and expiry date-labeling requirements. For the last two, there is an opportunity to check the normal, continuous practice of the labeler as the packages leave the production line. Unlawful variations from the routine would not be expected because of the impracticality of trying to evade the regulations (by using false dates) when it is anticipated that the inspector will not be checking. Shelf removal, however, requires a check every day on every shelf to be completely sure the statute and regulation are being complied with. Enforcement agencies cannot be expected to do such thorough checking, but consumers who are given the date after which the food is to be removed provide a built-in daily check of each shelf. If whatever date used on

the food required at some time to be removed is printed in code, this opportunity for daily checking will be lost. There seems, furthermore, to be no countervailing reason for using coded dates in connection with shelf removal laws, since the consumer would not in any real sense be misled by being given a date after which the food is required by law to be removed from the shelf, unless (a) the food remains consumable without significant danger thereafter, and (b) the statute permits some kind of nongratuitous disposition of the food after the expiry date--such as sale in a shelf area clearly marked as being for out-dated food which the consumer is purchasing at his own risk and knowing that the agency has set a durability period which has expired. Giving the agency the choice between coded and uncoded dating is more likely to be considered useful with respect to manufacturing date labeling, where the consumer is unlikely to know what use to make of the information--except to purchase the food most recently processed, which is perhaps contrary to sound policies of stock rotation.

In nearly all other respects, models (4), (5), and (6) are the same as (1), (2), and (3). The likelihood of a court declaring coded manufacturing date or coded self-selected shelf expiry date labeling to be in violation of the due process clause is even less than in the case of uncoded labeling--since the consumer cannot be said to be misled and the processor's injury is only theoretical (except for the cost of coded date labeling, which they are likely to be doing already).

7. Manufacturing Date Labeling (Statute-Uncoded)

8. Expiry Date Labeling (Statute-Uncoded)

9. Shelf Removal (Statute-Uncoded)

10. Manufacturing Date Labeling (Statute-Coded)

11. Expiry Date Labeling (Statute-Coded)

12. Shelf Removal (Statute-Coded)

Models (7) through (12) are the same as (1) through (6), except that there is no administrative agency which is delegated the authority to select foods to be regulated, to establish durability standards and make expiry determinations, or to choose between authorized alternative regulatory schemes. Rather, these decisions are made initially by the legislature and specifically included in the statute. The absence of an administrative agency makes all these models significantly less flexible and adaptable to changing technology and advances in knowledge about durability of particular kinds of foods. As mentioned above, legislatures take considerably longer to collect and assess facts and to act thereon than do administrative agencies. More importantly, however, legislatures cannot be expected to become experts in a particular field of activity or in the problems of regulating particular kinds of activity. Administrative agencies are expected to become experts in the activity they regulate, and indeed are designed for that purpose. Problems of definition of foods to be covered by a regulation, of label-printing details, and of accommodation to changing laws of other States are also likely to become compounded if they must be resolved by legislative committees and statutory amendment rather than by an agency.

Technically, there is a difference in terms of the rules of judicial review between statutes and regulations which impose the same requirements. To support a legislative determination, there must be a potentially real set of facts which would justify the legislature in choosing the method of achieving its purpose. To support an administrative determination, there must actually be demonstrated facts ("substantial evidence in the record") which support the agency's determination. Both must exercise judgment, however, and in fact there is probably no more difficulty in justifying one kind of regulation than in justifying the other. In other words, if (1) through (6) would be sustained by a reviewing court, so would (7) through (12).

13. Retail Shelving Date Labeling (Agency)

This statutory scheme is designed to serve a purpose somewhat different from any of the above. The major intent of date-of-retail display is to provide the consumer with a reference date near that of purchase time to enable intelligent in-home utilization and to avert over-long holding before consumption. Many foods are held almost indefinitely by consumers with undue confidence or apathy as to age. Deterioration is as much or more a hazard at home as anywhere in the chain of handlings following manufacture. Frozen foods are especially subject to over-confident long storage at home. Retail dating seems the logical beginning reference time for the consumer's timetable of food age.

An alternative, which averts shelf choice and discrimination by the consumer, is dating by the check-out clerk of each purchased item or package. This seems a time-consuming imposition on both the clerk and the purchaser.

Shelving date labeling does not account, of course, for differences in transportation time or preshelf storage time. It imposes no requirements on manufacturers or processors, unless one of its provisions were that manufacturers were required to provide some place on the package to put the shelving date, perhaps with a preprinted notice which identifies the date as such. (If the last were a part of the statute, the risk is increased that it will be declared an unlawful burden on interstate commerce because it would clearly favor local manufacturers who would not need two kinds of labels. Out-of-State manufacturers would for practical reasons probably have to omit the blank space and the notice that the retailer will provide a shelving date from food packages sold in or shipped to other States.)

If the regulation is not directed in any way at manufacturers, but only requires in-State retailers to supply a shelf date, then there is no danger of the statute being declared invalid as an unreasonable burden on interstate commerce. There is no tendency to favor or give protection to local manufacturers who sell only within the State, and imposing requirements on local retailers has no effect on interstate commerce.

The cost of administering and enforcing a shelving date labeling requirement would be relatively low, since it requires no inspection of manufacturers' practices, and no difficult determinations must be made about durability periods for particular foods and the like. Random checks at the retailers to make sure

that the shelving date is being stamped would be all that is required. Consumers would tend to aid enforcement, of course, and would tend to prevent postdating, which would not thereafter be detectable by a public enforcement official.

Flexibility and adaptability to changing knowledge is provided by the delegation of authority to an administrative agency. In the case of shelving date labeling, however, flexibility may be relatively unimportant--presumably, it makes sense to rotate all food stock to assure that the first shelved is first sold or that old stock is avoided by consumers when fresh stock is available. There is probably less need, therefore, for the kind of expert judgment which usually is the reason for delegating authority to an agency. And the cost which creating and staffing an agency would entail must be considered as an affirmative reason for avoiding the use of an agency if this kind of regulatory scheme is adopted.

14. Retail Shelving Date Labeling (Statute)

This model is identical to number (13) above, except that it does not contemplate the use of an administrative agency to select foods to be labeled by the retailer. It is to that extent less flexible than the above, but flexibility may be an insignificant or unreal advantage in shelving date labeling. If rotation and/or first-in, first-out stock control is desirable, it is probably desirable for all foods or all foods of an easily identified class (frozen foods, for example) and the foods to be covered could be identified and described at the outset by the legislature. There is no apparent need here for provision for change in the future, at least on any scale which might make an agency justifiable.

Even if no agency is delegated, the responsibility of choosing the foods to be labeled or of making any other decisions about what will be covered by the requirement, existing agencies could be empowered to enforce the rule.

Again, the consuming public may be the best enforcers of the requirement, provided they are given instructions about the significance of the date imprinted on the package (for example, by prominently displaying a large poster which tells consumers about shelf dating).

15. Retail Receipt Date Labeling (Agency)

This model is somewhat similar to number (13) above, except that the date required to be placed on the food package is the date on which the retailer received the food. The additional burden on the retailer, who must somehow note on shipping cartons the date of receipt and then repeat that date on consumer packages, is obvious. But the additional burden in no way adds to the likelihood that a court would invalidate the statute as being a denial of substantive due process. Clearly, providing the consumer with the date of receipt by the retailer bears some relationship to protecting the consumer against the sale of outdated foods. It does so in the same way as a shelf-dating requirement--be tending to assure stock rotation and sale of first-in food first. It adds, however, an incentive to the retailer to place food on the shelf for sale in the order of its receipt by him.

Enforcement of this model would be difficult to achieve, if it could practicably be done at all. There is no way to assure the accuracy of the date placed on the consumer package, except by checking (a) the shipping carton at the time of receipt at the retail store, and (b) the consumer package at the time the date on the shipping carton is transferred to the consumer package. There is no effective way of checking the date after the fact, either by an agency or by the consumer.

16. Retail Receipt Date Labeling (Statute)

This model is the same as number (15) above, except that the administrative agency is omitted. Flexibility in food selection is thus eliminated, but the loss may be negligible; see the discussion of numbers (13) and (14) above. There seems to be no particular need for expertise, unless the need for controlling storage by retailers before shelving is clearly nonexistent in the case of some foods, and there is some reason why labeling that food would be particularly harmful to the retailer. In other words, whatever value there is in retailer receipt date labeling seems to apply equally to all foods, and there is probably no need for an agency to make exceptions. If so, this model is clearly preferable to number (15) simply on the basis of economy.

17. Refrigerated Storage and Handling Regulation (Agency)

This model is very general in its description, but is based on the Uniform Cold Storage Act, in force in several States in some form. See the statutes described in Appendix I below. It contemplates giving an agency broad powers to control the manner and duration of storage and shipping of any foods which are normally refrigerated, without specifying what kinds of controls may be imposed and without mentioning specifically date labeling of any kind.

The statute does not on its face interfere with any Federal laws, and is therefore not invalid because it invades an area preempted by Congress. (See the discussion on this point in the section on "Federal Law Limitations," above.) There may be individual applications of the statute which would interfere with some particular Federal law (because of the food it covers or the activity to which it applies), but that would not invalidate the whole statute or interfere with its overall effectiveness.

The statute would clearly not violate due process limitations, since it would be presumed that any rules promulgated thereafter pursuant to it would be related to the public health and safety, and the statute itself does not cause injury to manufacturers or handlers, since it imposes no controls by its terms. Nor should it be declared to be so vague that it constitutes an unlawful delegation of legislative authority. Some standard (e.g., imminent perishability if not refrigerated) would have to be provided to guide the agency's selection of food, and some general description of the kinds of controls which are authorized (e.g., storage time, storage temperature, date labeling for inspection purposes) would have to be provided in the statute. They can be general enough, however, to give an agency discretion to do almost anything which would be thought reasonable, without at the same time being so vague that the courts will declare that they provide no standards at all.

The most outstanding feature of this model is flexibility. It permits an agency to choose from a wide variety of controls, depending upon its judgment about what seems appropriate for a particular food. It does apply only to food requiring refrigeration, but that seems to be the class of food for which the manner and duration of storage and handling are most critical.

18. Refrigerated Storage and Handling Regulation (Statute)

This model is the same as number (17) above, except that the complete storage and handling regulations are set forth in the statute. The foods to be covered by the controls must be chosen when the statute is designed, together with appropriate controls for each where variations are appropriate. The statute is therefore substantially less flexible than the delegation to an administrative agency contemplated by number (17) above. Since the statute on its face authorizes control of cold storage by manufacturers, distributors, carriers, and retailers, the possibilities for changing need or subtle variations among different foods seem large. The apparent need, however, for the flexibility and expert knowledge of an administrative agency must be weighed against the added cost if an agency is used.

19. Consumer Storage Instructions (Agency)

This model contemplates what may turn out to be the most elaborate or complex set of regulations. An agency would be charged with the task of selecting food for which a particular kind of storage by the consumer is appropriate or necessary to prevent deterioration, and the statute thus provides for flexibility by so delegating its authority.

There is no substantial question about the validity of the statute, since it does not itself impose any controls and no one can therefore complain of being injured by it. Regulations promulgated under such a statute would be tested by the traditional rule of reasonable relationship to a valid legislative interest, and should be easily supported, provided the agency's findings and reasons are minimally plausible.

The cost and difficulty of enforcement, of course, depend upon the complexity of the regulations to be promulgated and the number of persons whose activity is regulated.

20. Consumer Storage Instructions (Statute)

Since the statute does not contemplate delegation to an administrative agency, the storage instructions to be provided to consumers will have to be set forth in full in the statute. Flexibility is thus sacrificed, and it may be needed in this scheme more than elsewhere.

As is true in number (19) above, there is no real question of the validity of the model.

It should be noted here that as an alternative to numbers (19) and (20), manufacturers of selected food products could be required to label those foods with storage instructions (time and temperature, for example) they themselves

consider appropriate to maximize the undeteriorated storage life of the food. This would eliminate for the legislature or an agency the difficulty of designing and enforcing elaborate storage regulations and would decrease the chance that the regulations would be held to impose an unreasonable burden on interstate commerce (which would at least be a possibility if controls were imposed which were contrary to those which other States may enact).

21. Appliance Standards and Coordinated Storage Instructions

This model is based on the British Standards Institution system of regulating consumer frozen foods storage instruction, the details of which are as follows: Household refrigerators are marked with one, two, or three stars, depending whether the "basic test temperature" of the refrigerator's frozen food compartment is 21.2° F., 10.4° F., or 0.4° F. The maximum permissible storage time in one-star, two-star, and three-star compartments is marked on the frozen food package by the food manufacturer.

The details of this scheme could be created either by statute or authorized administrative agency, since the only decisions to be made are about the three frozen food compartment temperatures. The content of the instructions to be given the consumer about storage life in each of the compartments is left to the manufacturer.

There seems to be no substantial likelihood that a scheme such as this would be declared unlawful as an unreasonable restraint on interstate commerce. Although the star markings would be useful only in New Jersey, some method of segregating and marking only those refrigerators intended for sale in New Jersey could presumably be developed, or the star markings could be placed on refrigerators sold in New Jersey at the time they are sold. The burden on out-of-State manufacturers, if any, would be shared by any located in the State, and the burden is no more than necessary to protect consumers from differences in refrigerator standards.

22. Shipping Carton Manufacturing Date Labeling (Agency)

This model clearly would not be held to exceed constitutional limitations if the date-labeling requirements discussed above would not. Indeed, this model is less burdensome than those which may tend to mislead consumers by providing information they cannot use, and it avoids disputes about the length of time a food may be sold without deterioration.

Flexibility is not, perhaps, very important here, but it is assured in any event by delegation to an administrative agency, which can adapt the administration of the statute to changing needs.

Enforcement difficulty would be the same as in the case of consumer package date labeling, except that the enforcement load should be easier since there are fewer packages to be dated. No retail inspection is contemplated by the model as described, absent a first-produced, first-sold stock control requirement.

The purpose of the model is to enable the retailer to sell first that stock which was produced first, so that both he and the consumer will not suffer from the sale of stale or deteriorated food. It would, the model assumes, be to the retailer's advantage to assure that the consumer is not unhappy because of the purchase of older food where unusual delay in getting the food to the consumer can be avoided. The retailer would therefore use the information provided on the shipping carton to sell first the food with the earliest date stamped on it. If these assumptions about retailer behavior are accurate, the model is self-enforcing at the retail end--the interest of the retailer is the same as that of the consumer on this point. Whether consumers are likely to be disturbed enough about the delay between processing and retail sale to make their dissatisfaction known to and felt by the retailer is a question which ought to be answered if this model is to be adopted without an additional first-processed, first-sold requirement being imposed on the retailer.

23. Shipping Carton Manufacturing Date Labeling (Statute)

This model is identical to number (22) above, except that the responsibility of selecting the food to be labeled is not delegated to an administrative agency; the selection and the details of the labeling requirement are set forth in the statute itself. Flexibility, which it has been suggested above may not be important here, is thus sacrificed. In all other respects, the model would be the same as number (22).

APPENDIX I. DATE LABELING AND RELATED STATUTES (INDIVIDUAL STATES)

ALABAMA

Title 2, section 274(2) of the Code of Alabama, Recompiled (1958), requires that eggs be marked with the date on which they were graded. Label size and enforcement procedures are delegated to the State Board of Agriculture and Industries, the general powers and duties of which are outlined in title 2, section 317 of the Code.

ARIZONA

Section 44-2161 of the Arizona Revised Statutes Annotated (1956) requires that all loaves of bread over 3 days old from the time of baking be deemed stale bread and sold as such. No mention is made of so labeling the bread on the package, but presumably the bread would have to be removed from the regular bread shelves altogether or placed in some section marked for stale bread. Presumably also, therefore, all bread is marked with some kind of dating label, probably in code.

Section 36-904 prohibits manufacture, production, packaging, sale, or offering for sale of mislabeled food. Section 36-903 provides that food is mislabeled if "In the case of butter, eggs, and poultry when offered for sale, they have been kept or packed in cold storage or otherwise preserved and that fact is not indicated by written or printed label or placard which plainly designates the fact and the date of placing in cold storage."

ARKANSAS

Section 82-1312 of the Acts of Arkansas requires that egg containers be marked with the date on which the eggs were packed. Enforcement of the provision is delegated at least as a primary matter to the State Board of Health.

In 1951, the Arkansas State Board of Health adopted regulations pertaining to the operation of canning plants. The regulations require all food-canning plants to submit for approval a code "to appear legibly on each final container," which shall show the plant, batch, product, and date and year packed. Since the information is to be provided in code, the provision is clearly not designed to provide consumers with information about the product, but is rather for use by the State Board of Health in ways which do not appear in the regulations.

Pursuant to Arkansas Statutes section 82-110, regulations have been promulgated which require frozen foods to be labeled by a code registered with the State Health Department showing the date of packing. In addition, a regulation requires that retail stores "employ the first-in, first-out basis of inventory control." It is unclear whether the latter requires rotation in consumer display cases or simply in the store's storage areas.

The California Agriculture Code establishes several labeling requirements:

Section 37221 requires that butter manufactured outside California and shipped into the State for sale there be labeled with the date of manufacture.

Section 37971 requires that plants which manufacture cheese label all cheese made from raw milk, except that which is cut and wrapped into individual consumer packages, with the date on which the cheese was manufactured. Apparently this section is not designed to provide the consumer with information regarding the production date of the cheese, and indeed the exception seems designed specifically to keep such information from reaching the consumer.

Section 38952 empowers the Director of the Department of Agriculture to promulgate regulations requiring "any other information to be included on the label which the director determines to be in the public interest." By its terms, this section would empower the director to promulgate regulations requiring all packaged food to be labeled with the date of manufacture if he found such a requirement to be in the public interest. However, courts might not construe the statute to give the director such broad powers if they are not mentioned specifically in the statute. No such regulations have been located, nor have any cases interpreting such regulations been reported.

Division 17, section 12475, requires canning plants to file a dating code and to show on each canned container, using the code, the year of canning and the batch number or day of canning. In addition, section 12470 requires that each licensed retort operator shall keep a record of the cooks as required by the State Board of Health.

Division 17, section 220.57(s), requires containers of pasteurized egg products to have the date of pasteurization marked indelibly on them. The code is to be filed with the State Department of Public Health.

Division 17, section 11350, requires out-of-State egg products shipped into California to have attached a certificate supplied by a representative of a Government body in the State of origin; the certificate is to show the date of cracking and the date of freezing ("or drying, etc.").

Division 17, section 11355, applies the requirements of section 11350 to egg products imported from outside the country.

Chapter 5 of Division 21 constitutes California's Cold Storage Act. It is not the Uniform Cold Storage Act, but it provides somewhat similar controls in abbreviated form. Section 28146 establishes a 12-month limit for foods kept in cold storage, unless the period is extended by the Board of Health. Section 28147 provides expressly that the Board of Health may extend the period for particular lots of food in cold storage, provided the Board finds that the lot in question is not deteriorated and may be kept in cold storage for a longer period. There seems to be no requirement that food packages or lots of food received for storage be labeled with the date of receipt, or that food packages or lots withdrawn from storage be marked with the date of withdrawal.

COLORADO

Section 7-9-3 (6) of the Colorado Compiled Laws requires that every container of eggs for sale to consumers have imprinted thereon the date of candling or some other means of notifying the consumer of the eggs' freshness as approved by rules and regulations. No such rules or regulations have been located, nor have any cases been reported interpreting or applying the statutory provision or any regulations promulgated thereunder.

CONNECTICUT

In 1961, Connecticut amended a statute (§22-197) to eliminate the former requirement that milk which had been pasteurized more than one week prior to sale be labeled "Pasteurized more than one week." The statute now clearly provides that milk does not have to be date labeled in any way.

Section 19-207-5(E) of the Connecticut General Statutes requires all frozen foods to be marked with "permanently legible code marks" on each container or package, showing, inter alia, the date of packing. In addition, section 19-207-5(E) (10) requires the packer to place the packaged food in the freezer within 30 minutes of packaging. Violations are punishable by fines of \$100 for the first offense, and \$500 for subsequent offenses.

DELAWARE

Chapter 45 of the Delaware Code regulates food storage by warehouses, and several sections of the chapter deal with durability.

Section 4502 prohibits cold storage warehousemen from accepting for storage any food (except fruits and fish) not marked with the day, month, and year of receipt into cold storage. Section 4503 similarly prohibits removal from cold storage of food not marked with the date it was received by the warehouseman for storage.

Section 4504 prohibits storage for longer than 12 months without the consent of the Board of Health. Food kept for a longer period than is authorized must be sold at public auction within 60 days of the end of the authorized period (unless it has been declared unfit for consumption, in which case it must be destroyed).

These two sections essentially enact all the important provisions of the Uniform Cold Storage Act, except that fruits and fish are exempted from the coverage of the statute.

FLORIDA

The Sanitary Code of Florida, Chapter 170c of the Florida Statutes, contains several date labeling requirements:

Section 19.08(1) requires that packages of frozen shellfish shall show date "or code" of packing. If it has been repacked, the package shall show the "actual date of repacking." It is not clear from the statute whether

the latter provision does not permit code dating of repacked shellfish, although the term "actual date" might be so interpreted.

Section 17.10 requires that crustacea meat packed for freezing shall show date "or coding" of packing.

Section 601.11 empowers the Florida Citrus Commission to establish standards for and make rules and regulations governing marking, branding, labeling, tagging, or stamping of citrus fruits. This broad power seems to cover by its terms date labeling, but whether the Florida courts would so interpret the statute without some statutory standard for determining the kinds of regulation which the commission could promulgate is an open question; there are no reported cases on point. See also sections 601.10 and 601.12, which describes in broad terms the powers of the Commission to promulgate regulations and establish standards.

Section 583.02(2) of the statutes requires that eggs which have been kept in cold storage be so labeled when sold.

GEORGIA

Section 42-606 of the Georgia Code Annotated describes in very broad terms the power of the Commissioner of Agriculture to promulgate rules and regulations to provide for the labeling of milk and milk products "in such manner as to indicate that the milk or milk product complies with the provisions of this chapter and the rules and regulations promulgated hereunder." Dating is not mentioned, but the section might be construed to empower the commissioner to require date labeling. No such regulations have been located, nor have any cases dealing with the subject been reported. Section 42-306(a) makes it unlawful to sell any food products which do not conform to labeling regulations.

HAWAII

Section 328-43, et seq., of the Hawaii Revised Statutes (1968), enacts for Hawaii the basic provisions of the Uniform Cold Storage Act. Section 328-43 requires that food received for cold storage be marked plainly with the date of receipt for storage, and that food withdrawn from cold storage be marked with the date of withdrawal. Section 328-45 prohibits retaining food in cold storage for more than 12 months, except with the permission of the Department of Health. The statute provides that the Department shall grant applications for extension of the period if, upon examination, the food in question is found to be in proper condition for longer storage.

Section 328-47 provides that uncooked foods kept in cold storage must be marked by any person thereafter selling it with a sign reading "These are cold storage goods" "in large, plain type."

Sections 328-61 and 328-62 provide that food products previously frozen and then thawed out before sale (unless "canned, pickled, or preserved") must be labeled "PRODUCT PREVIOUSLY FROZEN." It is interesting to note, however, that the provision does not apply to food shipped outside of Hawaii for sale.

There is no indication whether this exception is designed to prevent the statute from being declared an unlawful burden on interstate commerce or is designed merely to enable Hawaiian producers to sell possibly inferior goods to out-of-State purchasers.

IDAHO

Section 37-2001 of the Idaho Code (1961) places cold storage plants under the supervision of the State Board of Health, but there are no substantive regulations in the statutes concerning the operation of cold storage plants.

ILLINOIS

Section 55(e) of the Illinois Revised Statutes requires that eggs shipped into the State must be recandled if not sold within 30 days of the original candling date, which date must appear on the retail container label in letters at least 1/8" high. Enforcement is delegated to the Department of Agriculture.

Section 220 provides that the powers of counties, cities, villages, or towns are not impaired by the act regulating milk grading; "However, no county, city, village or incorporated town shall require the carton or container to show the date of processing, or a date before which such grade 'A' products must be sold, or after which date such products may not be sold." It does not appear in the statutes or elsewhere in available sources that the prohibition on local date-labeling requirements was enacted as a result of experience with such requirements or as a result of repeal of State date-labeling requirements. At one time, however, the city of Chicago required all bottled milk to be sold within 48 hours of pasteurization, and that the milk container be labeled accordingly. Milk not sold within the limit had to be returned to the dairy and dumped. See Witter, et al., "The Keeping Quality of Pasteurized Grade A Milk Offered for Sale in the Chicago Market," Bulletin 646 of the University of Illinois Agricultural Experiment Station (1959). It is clear that the Chicago labeling requirement would no longer be valid or enforceable, since the State prohibitory statute would supersede it.

In addition, Illinois has enacted the major provisions of the Uniform Cold Storage Act in chapter 56 1/2. Section 79.7 requires that articles received for storage in a refrigerated warehouse shall be identified with a lot number which distinguishes the food from food received earlier or later for storage. The lot numbers, together with the date of delivery to the warehouse and the date of withdrawal therefrom must appear on all records pertaining to the food, and on all memoranda or other writing referring to the food. Section 79.8 limits the normal period of permissible storage in a cold storage warehouse to 24 months. The Director of the Department of Agriculture may extend the period. Section 79.9 makes it unlawful to represent or advertise as fresh any article of food which has been in refrigeration for a period of 30 days or more. Section 93.31, which applies to locker plants, requires that fresh fish placed in a locker plant be marked with the date of wrapping for locker plant storage.

INDIANA

Apparently by regulation, the Indiana State Board of Health requires all canned meat products and "meat and meat food products packaged in consumer-sized impervious containers which are usually displayed in self-service display counters" to be marked by code with the date of canning. The coding system is to be filed with the State Board of Health. According to the Board, "the intent of the requirement is not to inform the consumer, retailer or distributor, but is for use by the manufacturer and official agencies for product identification and control." Presumably this provision does not apply to interstate sales subject to the Federal Meat Inspection Act, since it would impose an additional requirement, which is specifically prohibited by section 678 of the Federal statute.

Indiana has enacted the basic provisions of the Uniform Cold Storage Act. Section 35-2310 requires date marking of foods received for storage; section 35-2311 requires that records be kept of all receipts and withdrawals of particular food; section 35-2312 imposes a duty on the warehouseman to mark food withdrawn with the date of withdrawal.

Section 35-2314 requires that for food which has previously been kept in cold storage and is now being kept in cold storage again, a record must be kept "in a manner which will make the length of time since the earliest date of cold storage easily ascertainable from an examination of the mark, stamp, or tag on the food product or its container and from the record of receipt and withdrawal."

Section 35-2315 places a rather short time limit--9 months--on the period allowed for storage without the permission of the State Board of Health, which must determine that the food is still fit for human consumption before giving permission for extended periods of storage.

IOWA

Chapter 196 of title X of the Iowa Code of Laws Annotated requires in section 196.16 that the top and bottom of each case of eggs which have been candled be labeled with a certificate showing the date of candling. Enforcement is delegated to the Secretary of the Department of Agriculture in chapter 189 of title X.

Iowa has enacted the basic provisions of the Uniform Cold Storage Act in chapter 171. Section 171.5 requires that records of all receipts and withdrawals be kept. Section 171.10 requires that the packages or containers of all food kept in cold storage be marked with the date of receipt and the date of withdrawal. Section 171.11 limits the permissible storage time to 12 months, except with the consent of the Department of Agriculture. Section 171.14 prohibits representing or advertising food which has been kept in cold storage as fresh. It also requires, unlike the statutes of other States which have enacted the Cold Storage Act, that any person who sells or offers to sell "uncooked articles of cold storage food" shall display "in a conspicuous place a placard with only the words 'Cold Storage Goods Sold Here' printed on it." Details about size of sign and size of type are also provided.

KANSAS

Section 65-707(B)(4) of article 7 of the Public Health Code of Kansas provides that deliveries of cream by a producer, with certain exceptions, be "tagged by the buyer of the cream with a tag showing a date received, and such tags shall remain on the container until removed by the buyer of the next delivery." No processing date label is required, however. The provision seems designed to discourage long delays between deliveries to the processor, rather than any kind of delay in shipment to retailers or consumers. The use of the buyer to police the labeling scheme is somewhat atypical, but there is no reason to suppose it would not work or would not be a valid requirement to impose on him, since it is the consumer who is intended to be benefited by the requirement, and the imposition of a policing requirement on intermediate purchasers is a reasonable means to achieve that end.

In addition, the Kansas State Board of Agriculture has adopted a rule requiring all cream to be shipped to the creamery within 24 hours of purchase from the producer, with an exception where public carriers are not available. Presumably, this section would require some precision in delivery date and time labeling, although it would not require any labeling of production date or time.

To the extent that Kansas does require date labeling of any kind, as above, it is not designed to provide information to consumers, but rather to second purchasers such as processors and wholesalers. Consumers will benefit over the long run, it may be assumed, by the fact that second purchasers will want to keep delivery delays to a minimum.

KENTUCKY

Chapter 221 of Baldwin's Kentucky Revised Statutes Annotated regulates the operation of frozen food locker plants, but not in a manner similar to that established for cold storage warehouses in the Uniform Cold Storage Act. No dating requirements or limits on storage time are included in the Kentucky statute (which regulates storage and handling temperatures), and the authority delegated to the Commissioner of Health in section 221.030 is merely to enforce the provisions of the statute and not to promulgate regulations which add to the statutory requirements. He could not, it therefore seems, require in-and-out date stamping of packages of frozen food, nor could he limit storage time on a blanket basis.

Chapter 260 of the statutes, governing the marketing of agricultural products, requires that wholesale egg packs be labeled with the date of packing. See §260.540. There is no requirement that the container not be broken up for sale to consumers or that the date be labeled on any consumer packages.

LOUISIANA

Chapter 3 of the Sanitary Code of Louisiana provides in §3.04 that cases of eggs shall have imprinted on them, inter alia, the date of candling of the eggs. Section 3.042 limits the time after candling during which the eggs can be sold, unless they are refrigerated in a specified manner. It is not

altogether clear from the provisions cited here whether the ultimate consumer is provided with any of the information described here. Presumably he is not, since eggs are seldom sold to consumers in "cases."

Section 7.614 of the Sanitary Code requires canning plants to emboss on the containers of all foods the plant where the food was packed and the date and year of packing. The information is coded, and the code is to be approved by the State Board of Health.

Section 6.142 of the Sanitary Code requires that all containers of shucked shellfish be marked with the date of packing. "If the date is in code, a key to the code shall be supplied to the State Board of Health of the State in which the shellfish are packed." The manner of marketing is described as follows: "When containers are sealed with covers which become an integral part of the container and which will ordinarily be removed only by the ultimate consumer, the identification number and letter may be impressed in or permanently embossed, lithographed, or printed on the cover instead of on the side of the can.

Cold storage plants must obtain a license and pay a tax therefor, according to section 47.392. Section 40.1 establishes a State Board of Health, and section 40.11 gives the Board the responsibility for making rules and regulations to supervise cold storage warehouses, but no substantive regulations, controls, or prohibitions are included in the statute.

MAINE

Section 22-2161 of the Maine Revised Statutes regulates storage and transportation of frozen foods, but places no limits on storage time and does not require dating of food when it is placed in frozen food storage. The statute requires only "suitable refrigeration which shall insure good keeping qualities and under temperatures and holding conditions approved by the Commissioner of Agriculture." The Commissioner is empowered to promulgate regulations covering storage and transportation "in accordance with recognized standards necessary for the protection of public health and the preservation of such foods in wholesome condition." This broad grant of authority might cover an entry and/or withdrawal date labeling of all frozen food packages, but no such regulations have been located.

MARYLAND

Maryland has no date-labeling requirements, but the Uniform Cold Storage Act has been enacted there.

Article 43, section 236, of the Annotated Code of Maryland provides that articles of food placed in cold storage are required to have on the container or on the food itself a label showing the date the food was placed in storage and the date of removal from storage if it has been removed.

Section 237 limits the period of storage and requires that purchasers must be notified that goods kept in cold storage over 30 days are "cold storage goods" and not "fresh" goods. The food must be so marked "by the display of a placard plainly and conspicuously marked 'cold storage goods.'" The Director

of the State Board of Health is empowered to make "all necessary rules and regulations to carry this subtitle [on cold storage] into effect." Conceivably this section could empower the Director to require processing or packaging date labeling, but this seems unlikely since adequate provisions already exist concerning receipt and removal dating, and those are the crucial dates for regulating cold storage practices. An argument could be made, perhaps, that since section 237 empowers the Director to extend the permissible storage time, he needs to know the age of the packaged food to decide whether to extend the allowable time. Whether the Maryland courts would sustain such a regulation is not known; no cases dealing with the subject have been reported, and apparently no date-labeling regulations have been promulgated.

The Maryland State Department of Health has, however, promulgated regulations pursuant to article 43 which provide more detailed regulation of frozen food storage (temperature, defrosting, air circulation), and handling (maximum internal product temperatures at time of receipt by retailer). One provision of the regulations--that which specifically deals with peak sales periods such as Thanksgiving and Christmas--demonstrates the usefulness of giving rule-making authority to administrative agencies. In many instances, providing for unusual or extraordinary situations cannot be expected of legislatures if they must design the whole regulatory scheme in one stroke. Agencies, given the broad authority which the Department of Health has here, can deal with such needs as they arise.

MASSACHUSETTS

Title XV, chapter 94, section 5 of the Annotated Laws of Massachusetts provides that bakery products shall be "kept moving to the consumer without unreasonable delay," but there is no requirement in the statute that bakery goods be labeled with the date of manufacture, nor is there any mention of an alternative method of enforcing the no-delay requirement.

Section 70 of chapter 94 provides that food kept in cold storage may not be so kept for longer than 12 months without the permission of the Department of Public Health. Section 71 provides that cold storage food must be labeled with the date of receipt for storage. These sections and others enact the basic provisions of the Uniform Cold Storage Act, which was added to the Massachusetts laws in 1912.

Section 73A regulates the storage and transportation of frozen foods. The section is rather atypical and is therefore set forth here almost in full:

No person engaged in the business of storing frozen food or transporting such food shall store or transport such food within the commonwealth unless it is stored or transported under refrigeration which shall insure good keeping qualities and under temperatures and holding conditions approved by the director of the division of food and drugs of the department of public health. Said director may, after public hearing, make regulations for the storing and transportation of frozen food, including temperature control, sanitation, and other matters, in accordance with recognized standards necessary for the protection of the public health

and the preservation of such food in wholesome condition
Nothing in this section shall be construed to apply to delivery
of such food by a retailer to the purchaser.

The last sentence of the section leaves some question about the source of the qualification. There is no indication in the statute that the exemption of retail transactions was the result of experience or that there is reason to exclude the director of the department from consumer protection matters.

Section 91 of chapter 94 provides that eggs which have been in cold storage must be so marked, for both wholesale and retail sales, with "Cold Storage Eggs" on the container or on a card attached to the container.

Section 77B of the chapter requires that food fish deposited in private freezing plants be marked with the date of receipt for storage, but no mention is made of processing date or date of catch.

Section 77E prohibits cold storage of food fish from another State for more than 6 months unless the fish is marked with date of original deposit for storage.

Section 77G provides that containers of lobsters processed by rapid freezing be plainly marked with the date of processing. Rapid freezing is elsewhere defined in the statute.

Rule 5 of the Milk Regulation Board, promulgated pursuant to chapter 94, section 13, of the General Laws, places limitations on the allowable time lapse between drawing milk from the cow and delivering it to the consumer. No mention is made of labeling, but the rule seems to contemplate that the bulk container would have a production date and time marked on it; otherwise the rule seems unenforceable.

MICHIGAN

Regulation 541 of the Michigan Department of Agriculture (R. 285.541.1 to -11.) requires that unfrozen smoked fish containers, "including retail display cases or bulk lots," be labeled with a "warning statement" as follows: "'Not to be sold or consumed after _____,' the blank to be filled with date including month, day, and year, this date to be not more than 14 days after date of smoking."

Regulation 532 (R. 285.532.1 to -.12) requires in Rule 8 as follows with respect to "all containers used in the distribution and marketing of 'Michigan Seal of Quality' grade eggs":

Each container, package or subdivision thereof which may be opened shall contain on the principal panel, either by printing or sticking tape, in distinctly legible form a date, stated as the month and day or the number of the month and day, preceded by "Not to be sold after." The date shall not exceed 10 days from date of Haugh unit measurement test, including the day of testing. Upon the expiration of the 10 days, the eggs shall be removed from the labeled packages or the "Michigan Seal of Quality" identification and expiration date shall be completely obliterated.

Section 12.940(3) of the Michigan Revised Statutes requires that records be maintained of storage of fruits and vegetables in "controlled atmosphere storage." No details of the required record are provided in the statute, but the record shall be "on a form approved by the director of agriculture." This provision clearly would authorize the director to require entry and/or withdrawal date labeling of lots of fruits and vegetables so stored.

Section 12.965(4) provides that it is unlawful "to keep or display any canned meats or canned meat products at a temperature exceeding 50 degrees Fahrenheit if the label of such meats or meat products specifies that they shall be kept under refrigeration." Although the statute does not specifically say so, the requirement seems to be directed primarily to retailers.

Section 12.985(32) requires anyone "engaged in the business of buying for resale, selling, dealing in, trading in, transporting, candling, grading, sorting, packing or packaging" eggs for human consumption is required to maintain the storage temperature at 60 degrees Fahrenheit or below, except during the candling and handling activities.

MINNESOTA

Minnesota has no date-labeling requirements for food, but cold storage of all food is regulated under the Uniform Cold Storage Act. The day of receipt and the day of removal from storage must be stamped on the container or on the food itself. See Minnesota Statutes Annotated, chapter 28, §28.07. The maximum period of time during which food may be kept in cold storage is 12 months, but this period may be extended or shortened by the Commissioner of the Department of Agriculture.

Section 28.13 empowers the commissioner to make rules and regulations, "not inconsistent with law," to carry out and enforce the provisions of this chapter. Conceivably, this section could be thought to empower the commissioner to require date labeling, but it seems unlikely. See the discussion of the similar Maryland statute, supra.

MISSISSIPPI

The Mississippi Frozen Food Locker Act provides that wrapped food placed in a frozen food locker must be stamped with the date of wrapping. Mississippi Code Annotated, Title 25, Chapter 6, §7129-48.12. This section also requires that all food placed in a frozen food locker for storage be "sharp frozen" at an approved plant. "Sharp frozen" is defined in §7129-48.02(f) as "the freezing of food in a room in which the temperature is zero degrees Fahrenheit or below." Section 7129.48.11 provides complete temperature control regulations for such locker plants.

Title 19, chapter 1, §4435.30.13, regulating the marketing of eggs, provides that egg containers shall have on them a label describing the contents and listing the date the eggs were graded, or an expiration date as an alternative.

Section 4456, regulating the marketing of cream products, provides that each container of cream shall have a label or tag showing the date the cream was graded, but no mention is made of date of processing.

MISSOURI

Missouri has no date-labeling requirements, but section 196.490 of the Annotated Missouri Statutes provides that food to be placed in a locker plant must be inspected and wrapped and stamped with the date of wrapping. Section 196.485 regulates the temperature for storage, and requires that thermometer charts shall be kept available for inspection and shall be preserved for 1 year from the date of recording.

Section 196.680 of the Missouri Dairy Law declares that cheese is "misbranded" if it is in package form unless it bears a label containing the words "'aged over sixty days' and an identifying code indicating the date of manufacture if made from unpasteurized milk or not subjected to cheese pasteurization temperature."

MONTANA

Title 3, chapter 24, section 3-2455 provides that dairy products imported from outside the State must be labeled with the date the dairy product was shipped and the date it was received by the company offering it for sale in Montana.

NEBRASKA

Nebraska formerly required Grade A milk to be labeled with the date of bottling and packaging. Chapter 81, article 2(d), section 81-263.06 of the Nebrasks Revised Statutes. The requirement was held to be unconstitutional, however, in Lincoln Dairy Co. v. Finigan, 170 Neb. 777, 104 N.W. 2d 227 (1960), decided by the Supreme Court of Nebraska. The statute was subsequently repealed, and the marketing of milk is now regulated by sections 81-263.11 to -.35, the Grade A Milk Law, which makes no mention of date labeling of any kind.

Nebraska has enacted the basic time limit provisions of the Uniform Cold Storage Act in section 81-2.129. It may be that the date of receipt and date of withdrawal were required to be placed on packages of food prior to 1947, since part of the Cold Storage Act was repealed in that year. The sections repealed are not now available, however, so this cannot be concluded with any certainty.

The Frozen Food Locker Plant Law regulates the operation of frozen food locker plants, but no date labeling or time limit regulations are included in the statute.

NEW HAMPSHIRE

Chapter 145 of the New Hampshire Revised Statutes Annotated regulates cold storage, and enacts the provisions of the Uniform Cold Storage Act. Section 145:7 requires that "pending retail sale, all cold stored foods shall

be plainly marked with both the original date of entry into and date of withdrawal from cold storage. . . ." Section 145:10 provides that cold stored poultry and eggs must be marked: "Cold Stored" or "Cold Storage." Section 145.11 requires dealers, when requested, to tell the buyer the date cold stored food was placed in storage and the date it was removed from storage. Section 145.12 limits the period of cold storage to 12 months, but the period may be extended by the division of public health services. Section 145.14 prohibits the return to cold storage of food removed from cold storage for sale.

NEW JERSEY

As recently as June 1967, New Jersey imposed date-labeling requirements on milk-marketing companies. New Jersey Statutes §24:10-57.23 now require pasteurized milk and cream to be labeled with the day on which the milk or cream was pasteurized, or with the term "pasteurized during the 24-hour period ending 6 a.m." followed by the day during which the stated period ends.

A version of the Uniform Cold Storage Act has been enacted in New Jersey (N.J.S. 24:9-26 et seq.), which requires cold storage food to be marked with date of receipt and date of withdrawal. The maximum allowable storage time is 24 months, 12 months longer than is typical, unless extended by appropriate authority. Violators are subject to a civil penalty of \$100, \$200, and \$500 for first and subsequent offenses.

In addition, a New Jersey statute provides that municipal boards of health may adopt by reference model health codes approved by the State Department of Health. The State Department of Health has promulgated a Model Retail Food Establishment Code of New Jersey--1965, which has no legal effect unless adopted by local boards of health. The Model Code would require that frozen foods be kept at zero degrees Fahrenheit or below during transportation and storage, and that "potentially hazardous food" be kept at 45 degrees Fahrenheit or below or 140 degrees Fahrenheit or above during transportation and storage. "Potentially hazardous food" is defined as including, among others, foods consisting of "ingredients capable of supporting rapid and progressive growth of infectious or toxigenic micro-organisms."

It is not known whether any local boards of health have adopted the Model Code. Because of the multitude of political jurisdictions in New Jersey, the Code's standards would obviously be much simpler to enforce if the Code were adopted on a statewide basis as a statute; indeed, its enactment has been advocated.

NEW MEXICO

Section 54-4-13 of the New Mexico Statutes (1953) requires food placed in frozen food lockers to be labeled with the date of wrapping for storage.

NEW YORK

There are no statutory date-labeling requirements in the State of New York, but the following provisions in the New York statutes relate to the subject of food durability:

Section 234, et seq., of article 19 enacts the provisions of the Uniform Cold Storage Act, regulating refrigerated warehouses and locker plants. The length of time food may be cold-stored is limited, and records must be kept showing the date of receipt.

Section 160-e of article 13-A requires that retailers must be informed by the seller of eggs which have been kept in cold storage by placing the words "cold storage" or "refrigerator" on the invoice.

Sections 46 and 46-a of article 13-A, which were enacted in 1968, are worthy of note even though they are not substantive regulations. Section 46 is merely a declaration of policy by the legislature; it declares that the interstate movement of milk is good and beneficial to the citizens of New York because it assures an adequate milk supply. Section 46-a then empowers a public official to promulgate regulations concerning manufacturing, labeling, distribution, and sale of milk and milk products. Apparently, the legislature intended that regulations would be promulgated, but not so as to burden out-of-State manufacturers. No mention is made of date labeling, and there is no indication whether such a requirement would fall within or without the authorization, since it would tend to inhibit the free flow of milk shipments into New York.

New York City has by ordinance enacted expiry date-labeling requirements for milk sold or offered for sale in the city. Section 111.33 of the New York City Health Code provides that it is illegal to sell milk beyond the expiration date, which "shall not be more than 66 hours after 6 a.m. following pasteurization." Section 111.61 requires that retail containers be labeled as follows: "MAY BE SOLD UNTIL MIDNIGHT OF" followed by a date as in section 111.33, or "MAY BE SOLD UNTIL MIDNIGHT OF THE DATE INDICATED ON TOP" in the case of containers other than glass or plastic bottles. The date "shall be expressed by the first three letters of the month followed by the numeral or numerals constituting the appropriate calendar date."

NORTH DAKOTA

Although North Dakota has no production date-labeling laws, section 19-02-13 of the North Dakota Century Code (1960) enacts the basic labeling provisions of the Uniform Cold Storage Act. All food products in cold storage must be marked or labeled with the date of entry and the date of withdrawal. "Such stamp, tag, or label shall not be removed by any subsequent seller." The latter provision is an unusual one, and seems to assure that the consumer will obtain the dating information. No mention is made, however, of the event that the food in cold storage is in a bulk container that is subsequently broken down for sale at retail. Presumably, the act intends that the information must be available to anyone who purchases the food in any form, but it is not clear that the legislature has done so. No cases have been reported interpreting the section on mentioning this problem.

A statute has been introduced in the North Dakota legislature which would require processing date labeling on all foods defined as "perishable." The statute, North Dakota Senate Bill 120, 41st Assembly, has not been enacted and there is considerable opposition to it.

OHIO

Although Ohio does not have any food date-labeling laws, it does regulate cold storage warehouses in a manner similar to the Uniform Cold Storage Act. Sections 1155-11 and -12 of the Ohio General Code provide that all packages or containers of cold storage food be marked with the date of deposit and the date of withdrawal, regardless of how short a period the food was kept in cold storage.

It is interesting to note that Ohio expressly requires that the dating information be imprinted directly on the container, and that placing the information on a tag or label is not sufficient.

OKLAHOMA

Title 2, section 7-162 of the Oklahoma Statutes Annotated requires that all cheese sold in Oklahoma, except that which is cut and wrapped into individual consumer packages and certain other enumerated exceptions, must be labeled at the milk products plant where it is manufactured to indicate the variety, the plant number, and the date on which the cheese was manufactured.

Title 2, section 7-37 requires that containers of cream intended for butter making be labeled with the date it was received from the producer.

Title 2, section 5-43, regulating the marketing of prepackaged foods, provides in part as follows: "It shall be unlawful to keep for the purpose of sale or to offer or expose for sale, or sell any prepackaged meats unless the date such meats were prepackaged is shown clearly on the outside of the package. Such requirement for dating shall apply to both the wholesale and the retail package." The section must be limited, because of the prohibitions of the Federal Meat Inspection Act in section 678 thereof, to intrastate transactions or to meats repackaged after receipt from federally inspected meat processing plants. Nothing in the statute so limits its coverage, and it was amended as recently as 1968, but the Federal statute clearly would not permit its application to federally inspected meats.

The provisions cited above are enforced by the Department of Agriculture, which may apparently issue Stop Sale Orders against persons who market food in violation of the statute. It is not clear from the statutes what the legal effect of a stop sale order is, nor what results if the person against whom it is directed does not comply with it.

Before 1963, frozen food packages placed in frozen food locker plants had to be marked with the date of entry into storage and the date of withdrawal from storage. The requirement was repealed in 1963, but the reason for its repeal does not appear in the statutes.

OREGON

Section 621.330 of the Oregon Revised Statutes regulates the labeling of frozen dessert mixes as follows: "All containers of frozen dessert mix shall be conspicuously labeled as to the contents of the container, the name and

address of the manufacturer, or distributor, the date of manufacture. . . ." Enforcement of the section is delegated in a general enforcement section to the State Department of Agriculture.

Section 632.770(1)(a) of the statutes declares it is unlawful to "prepare, pack, place, deliver for sale or sell eggs in bulk or in containers or sub-containers" unless the container "or all subcontainers within each container" are marked with a date code "for identification" and other information. The section does not specify that the code shall be filed with the State, but presumably it contemplates such a filing.

In addition, chapter 603, section 22-360 of the Oregon Administrative Rules requires that egg containers be marked "in boldface type letters which are in contrast with background color" with a date code, which "shall be approved by and placed on file" with a State official.

PENNSYLVANIA

Pennsylvania has no statutes requiring date labeling of foods, but does regulate cold storage of foods by provisions adopted from the Uniform Cold Storage Act. A maximum storage time of 24 months is provided, rather more liberal than most other States which have enacted similar provisions. Extensions of time may be granted by order of the Department of Agriculture. See Purdon's Pennsylvania Statutes, title 31:13, section 972. Section 966 prohibits cold storage of foods not labeled in accordance with rules and regulations to be promulgated. The section does not mention labeling with the date of receipt or removal, but it clearly contemplates that such requirements could be imposed by regulation.

The Pennsylvania Department of Agriculture in 1964 adopted regulations for preparation and processing of frozen foods. Title 2, chapter XXIII, section 4 of the Department's rules requires that all frozen foods have "permanently legible code marks" on their "immediate container or package" showing the date of packing.

RHODE ISLAND

Rhode Island has no explicit statutory date-labeling requirements, but it does empower the Director of the State Board of Health in broad terms to make regulations concerning the packaging and labeling of milk. See Rhode Island General Laws title 21, chapter 31, section 22-2-23. By its terms, this section seems to grant the Director the power to make regulations requiring date labeling. Section 21-31-20(a), however, instructs the Director that regulations promulgated by him should conform as nearly as possible to Federal regulations. This section seems to limit the Director's discretion at least on subjects dealt with by Federal regulation. It is altogether unclear whether the Director is intended to have authority to make regulations concerning subjects not covered at all by Federal regulations.

Section 21-17-12 requires that cold storage eggs, as defined in the statute, must be so labeled. If the eggs are sold in bulk rather than in a container, then the information must be supplied on a placard to accompany the display of eggs.

Alone among the States, Rhode Island has enacted a statute apparently designed to encourage the uniform regulation of milk by the several States and to assure Rhode Island's cooperation in any efforts to achieve uniformity. See section 21-2-2. The precise purpose of and reason for the statute is not clear. Compare the similar statute enacted by the State of New York, discussed above.

SOUTH DAKOTA

South Dakota has no express statutory date-labeling requirements, but title 22, section 22.0803 of the South Dakota Code makes it unlawful to sell as fresh eggs any eggs which have been held in cold storage for 30 days. Presumably, this prohibition would require that eggs kept in cold storage be marked with either the date of receipt for storage or the date of hatching or candling. Otherwise the statutory prohibition would be difficult to enforce.

Chapter 39-3 of the South Dakota Code regulates the operation of refrigerated locker plants. Section 39-3-5 sets temperature limits, section 39-3-9 requires that all food placed in frozen food locker plants for storage be sharp frozen first, and section 39-3-11 requires that meat placed in storage must be wrapped and marked with the date of wrapping before freezing.

TENNESSEE

Title 52, section 52-204 of the Tennessee Code requires that all eggs be candled by the "licensed first purchaser" and that a certificate be placed in each case of eggs which shows the first purchaser's name, address, license number, and the date of candling.

Chapter 11, section 52-1101, et seq., regulates the operation of refrigerated locker plants. Section 52-1104 imposes comprehensive temperature controls, and section 52-1109 requires that all food placed in the locker plant for storage be sharp frozen first. No time limit is placed on frozen food storage in the locker plant, and no entry or withdrawal dates are required to be placed on the food packages or kept as a separate record.

TEXAS

Texas has no express statutory date-labeling requirements, but it has a fresh egg statute similar to South Dakota's above, and only difference being that it applies to eggs held in cold storage longer than 60 days. See title 71, chapter 15, article 165-8, section 9(E) of the Texas Revised Statutes.

UTAH

Utah has no statutory manufacturing date-labeling requirements, but it has enacted the Uniform Cold Storage Act, which requires receipt and removal date labeling of food kept in cold storage warehouses, and prohibits cold storage of food longer than 12 months. See title 4, chapter 1, section 4-23-7 of the Utah Code Annotated.

VIRGINIA

Title 3, chapter 16, article 3, section 3.1-467 of the Revised Statutes requires that bulk milk and bulk cream containers shipped into Virginia be marked with, among other information, the date of pasteurization and the date of shipment.

Section 3.1-558, which applies to a variety of food mixes which contain pasteurized milk products, requires that they be marked with the date of pasteurization when shipped to an "establishment other than the place at which it was manufactured." The section is not intended, obviously, to provide any information to consumers, but rather to purchasers (manufacturers, probably) from the milk producer.

Section 3.1-578 requires that containers of sweet cream or ice cream mix shipped into the State be marked by the shipper with the date of shipment and the date of pasteurization.

Title 59, chapter 2 enacts several of the provisions of the Uniform Cold Storage Act. Section 61.1-12 requires that records be kept of the date of receipt and the date of withdrawal of food placed in cold storage. Section 61.1-14 requires that the same dates be placed on a label on the packages of food. That section also requires that the words "cold storage" be placed on the label. Other sections require records to be kept of the temperatures maintained in the storage rooms and prohibit the return to cold storage of food once removed therefrom. Unlike many other States, Virginia places no statutory limit on the period of time during which the food may be kept in cold storage.

WASHINGTON

Section 69.24.240 of the Washington Statutes declares it unlawful to prepare, pack, deliver for sale, sell, etc., eggs in bulk or in containers or subcontainers unless each container and subcontainer is marked "as prescribed by regulations promulgated by the director together with a date for identification." Regulation 23 of the State Department of Agriculture further sets forth egg-labeling requirements as follows: "All egg and egg product containers shall bear a label or shall be stamped on the body of the container with . . . (d) a code or date for identification of each lot. This code or date identifies the contents with a specific date, run or batch of the product."

Regulation 8 of the Department of Agriculture rules and regulations pertaining to the operation of canning plants requires as follows: "Each cannery must submit to the department a code to appear legibly on the surface of each container that will identify the packer. This code will show the . . . batch number or day code." In addition, the process record and recording temperature chart shall be held for not less than 24 months, and shall at all times during that period be available to the Department of Agriculture.

WISCONSIN

The Wisconsin Administrative Code section Ag 46.09, which applies to the operation of smoked fish processing plants, requires that "all sale containers,

whether consumer-sized or bulk, shall be labeled to show . . . date of processing (day and month)." Section 46.10 further provides that "no smoked fish shall be sold under any processing date assigned by the processor. Smoked fish held beyond 14 days subsequent to processing date shall be immediately removed from sale and immediately destroyed or treated so as to render it unfit for human consumption."

Title 12, chapter 99 of the Wisconsin Statutes Annotated enacts a recording requirement for cold storage warehouses which may have been borrowed from the Uniform Cold Storage Act. Section 99.07 requires that each lot of food shall be identified with a "distinguishing lot number" and a record of the date of entry into and withdrawal from cold storage shall be maintained and shall appear on warehouse receipts and all other writing concerning the lot. No other labeling requirements are imposed, and no time limits for storage are included in the statute.

APPENDIX II. DATE LABELING AND RELATED STATUTES (FOREIGN COUNTRIES)

AUSTRIA

The Food Labeling Regulation of Austria, paragraph 453 of the December 30, 1968, Austrian Bundesgesetzblatt, requires that shelf life or expiry date, together with the time of packing or time of usability be placed on the packages for the following foods: meat and meat products, frozen meat and meat products (except poultry), partly preserved meat and meat products, preserved fish and shell-fish, storable vegetables (except legumes), frozen vegetables, partly preserved vegetables, vegetable juice, fruit products (except citrus fruits), marmalade, fruit juice and syrup, partly preserved fruit products, dietetic foods including baby foods, meat and protein extracts, whole eggs and egg yolks, baking and pudding powder, confectionery, chocolate in tablets, coffee, coffee extract and substitutes, dough products, some oat products, and edible oils and fats (Austria Food Labeling Regulation).

CANADA

Packing date labeling is required on some dairy products, graded canned meats, fruits, and vegetables. The source does not indicate whether the information is to be intelligible to the consumer or may be in code (Grose Study).

DENMARK

Milk and milk products - The date of pasteurization is required on retail containers of milk. The date of packaging is required on containers of sour milk and milk products. The day, month, and year of sterilization are required on containers of yogurt and similar products.

Eggs - The day of the week in which it is packed in required on packages.

Cheese - The date of production is required; this may be done in code.

Sliced meat products - Date of packing is required.

Frozen meat products - Month and year (of package) must appear; but this may be done in code. Wholesale packages must have the complete date.

Metwurst and bacon - The date of packing must appear on the retail package.

Fish products - Must have the complete date; but this may be in code.

Fresh fish - The retail package must contain the date of packing or the last date of permitted sale.

Canned fruit and vegetables - Must contain the year of production.

Marmalades (jams) - Must show week of production; this may be in code.

Butter - Legal requirements have been recommended for date of production, but not yet adopted.

Diet margarine - Date of production, or last day of permitted sale is required. This may be in code.

Suggestions have been made to amend the law to include the day of production or last day of use for frozen food packages.

The Irma Food Company (a cooperative) dates almost all of its products. It formerly designated the last day of sale. Now states: Will also be sold on. . . . (Koljonen letter).

FINLAND

Regulations of the Finnish Ministry of Agriculture provide durability controls of milk, cream, buttermilk, packed eggs, broths, and fresh blood (used in food preparation).

Pasteurized milk, cream, and buttermilk not in retail containers must not be kept for sale or sold later than 2 days following pasteurization. Milk, cream, and buttermilk in finished containers must be sold within 3 days. In the case of the latter, the latest permissible selling date must be marked in a day code (number of the day of the month) on the container (Aalto letter).

The packaging date must be marked on containers of packed eggs, broth, and fresh blood (Aalto letter).

In addition, the Ministry of Commerce and Industry may order labeling of "vitaminized" products with the date to which the vitamin retains its potency, and after which it may be destroyed (Grose Study).

GREAT BRITAIN

The Refrigeration Industry Standards Committee of the British Standards Institution has promulgated the Three-Star system for labeling refrigerator frozen food compartments and labeling frozen food packages to correspond to the marks on the compartments. The system is described above in the section titled "Analysis of Regulated Models."

The extent to which the promulgated "specifications" are official or have the force of law is unclear. The British Refrigeration Association and the National Association of Frozen Food Producers were represented on the Committee, so apparently use of the "specifications" may be widespread even if voluntary. Information concerning the aegis under which the Committee was operating has not been found (British Standards Specification).

ICELAND

Milk is the only food which is required to be dated. It has not been specified in available information if this is a packing date or an expiration date.

Coffee required dating during a 1-year trial, but that requirement has been discontinued (Koljonen letter).

JAPAN

The date of manufacturing is required to be on the label of cream, ham, sausages, and some canned foods. As an alternative in the case of cream, it may be marked with the final date on which the cream should be sold. Although it does not appear directly from the source, the information must apparently be intelligible to the consumer, since the alternative in the case of cream is presumably a consumer-informing scheme (Grose Study).

LATIN AMERICA

The Draft Latin-American Food Code provides in article 86 as follows:

Containers, the contents of which may deteriorate once the container is opened, shall have a warning marked on the principal or a secondary label to the effect either that the product must be consumed immediately, or (for canned products) that once the can has been opened, the part of the contents not immediately consumed must be kept in glass, pottery, or plastic containers. (Latin American Code)

NEW ZEALAND

The label of "standard milk" must have on it the date of packaging or the "next day." It does not appear from the source whether the information is to be intelligible to the consumer or may be in code. (Grose Study)

NORWAY

Some prepacked and sealed but not hermetically sterilized or deep-frozen fresh meat and fish must be labeled with the date of manufacture and the date until which the product is guaranteed to maintain its quality. Such foods must also be labeled "Must be kept cold." (Grose Study)

All products which require refrigeration must be labeled "Keep under refrigeration below 40° F." or with "Words of similar import." (Grose Study)

Avskrift. SOSIALDEPARTEMENTET, Jnr. 10873/66 S.D.H.5. Rundskriv nr. 23/66 H.5. Oslo, 25. mai 1966. Etter Fullmakt

This regulation contains the latest requirements for showing net weight on closed package (except bottles, hermetically sealed items, and frozen foods), containing food products in general. The weight may be indicated on the label or directly on the wrapping.

The regulation further requires that packages containing meat, meat products, fish, and other "easily perishable" items carry date of production and shelf life indicated by a "use before _____" type of statement. It does not state who determines how long a product may remain in the package and still be safe for consumption. The Department of Health may waive the requirement for showing net weight. This is particularly true in the case of cookies and cakes wrapped or sold in transparent packages or containers. Other dispensation (as to production dates and shelf life) may also be granted in special cases.

For the purpose of this regulation, "easily perishable" products are defined as products that satisfy the two following conditions simultaneously:

- (a) pH more than 4.5
- (b) Level of " H_2O activity" more than 0.9.

SOSIALDEPARTEMENTET, Helsedirektoratet, Jnr. 13031/63 H.5. Rundskriv nr. 50/63 H.5. Oslo, 28. August 1963.

This is a regulation that states the requirements for indicating shelf life on all hermetically sealed packages containing meats, cold cuts, ham, salads, soups, and some other similar products.

It is pointed out that cheeses, mustard, bread, cakes, and mayonnaise are not included in this regulation.

FORSKNINGSUTVALGET FOR KONSERVEN. Ullevalsveien 72. Oslo 4.

This paper contains the recommendations of a committee that was established to:

- (a) Deal with the problem of whether or not closed packages (not hermetically sealed) should be returned to the producer on distribution.
- (b) Try to establish a specific realistic shelf life for each of practically every type of meat and meat product on the market and sold in closed packages (other than hermetically sealed and frozen foods).
- (c) Try to establish specifically what products are included in the regulation.

The committee's recommendations are:

- Re (a) - Meat products should not be permitted to be returned to producer on distribution.
- Re (b) - A long list giving recommended maximum shelf life for each of all kinds of meat and meat products.
- Re (c) - Not clarified. Further work needed. Also recommends that the term "production date" be changed in regulation (1) to read "packaging date."

SWEDEN

The Swedish Food Law Committee, commissioned by the Government of Sweden to make recommendations for reorganization of Sweden's food laws, has recommended the following laws concerning durability:

Each package of prepackaged food shall be provided with a label containing the following information:

. . .

(b) a satisfactory directive in the Swedish language concerning the conditions under which the package should be stored or kept, if the application of such a storage directive shall be of essential importance for the durability of the food.

Regarding such prepackaged food which, by storing or keeping in accordance with the storage directive mentioned under 2 (b), nevertheless can be assumed to submit to such adverse changes that the food within such time, during which it is apparently meant to be stored or kept, becomes dangerous to eat or otherwise within 30 days becomes unfit for human consumption, the package must be furnished by the packer with a durability labeling, showing either the day when the food by storing or keeping (undergoes) adverse changes aforementioned . . . , or the day when the food has been packed . . . , and the time thereafter, during which the package is intended to be stored or kept in accordance with the storage directive without risk for the food to submit to the adverse changes. . . .

. . .

Durability labeling must be carried out in such a fashion as to be unmistakably clear to the consumer.

Specification of the packaging day or the last consumption day must indicate day, month, and year. The specification of durability time must be given in number of days concerning food with a durability estimated as 30 days or less and in number of weeks or months concerning food estimated with a longer durability.

(Swedish Food Law Proposal--It is not known whether any of these recommendations have been or are likely to be adopted.)

UNITED NATIONS

In September 1968, the Swedish delegation to the Codex Committee on Food Labelling recommended that where prepackaged food durability depended on special storage conditions, the Codex Commodity Committees concerned should provide storage instructions to be placed on the label by the producer or the packer.

At the same time, the West German and Swedish delegations objected to the recommendations of the Joint Group of Experts on Quick Frozen Foods that the use of expiry date labeling should not be mandatory. The two delegations wanted to add the following:

- (b) There shall be an indication, in clear print, of the date of production, date of packaging, or expiry date.
- (c) There shall be instructions for keeping, indicating the specific temperatures at which it is recommended that the food be kept.

(Codex Food Labelling Report - 4)

By March, 1969, however, the Joint Group of Experts still maintained their position that date labeling should not be mandatory. The "shall" in the first sentence of the West German/Swedish recommendation above became "may" in the Joint Group's report (Food Standards Program - 6).

VENEZUELA

The "period of life" is required to be on the label of all food "products of limited life," although the source does not indicate what is considered to be a "limited life." Nor does it indicate whether the information is to be intelligible to the consumer or may be in code. (Grose Study)

WEST GERMANY

Abstracts of the Declarations

All products or components of meat, fish, crustacea, or mullusca, whenever these are offered to the consumer in packages or containers, are especially included in the new labeling directive of January 1, 1968. Basically, all declarations must be made in the German language, be distinctly visible and easily read. These statements--as well as pictorial representations on the packaging material or the label--must correspond with the actual contents and must not arouse a false conception in the buyer. Some specific designations regarding products are to be made:

1. Producer or packer (individual or company)
2. Location of principal establishment, domestic or foreign
3. Customary trade designation, in the German language, of designation of type of animal.
4. Total weight of contents (net weight for products which contain other ingredients besides meat or fish).

5. Meat - meat weight loss in grams (weight of the meat, including fat, or meat portion according to German measure of weight at the time of the filling, indicating change in weight due to further handling, and declaration "with bones" if the meat contains bones); and loss of weight during heating, etc.
6. Time of production, packing and filling:
 - a) For example "produced on..."
(The date should be clearly separated from other wording according to the day, month, and year. In addition "Limited storage life even when refrigerated." For storage items, preserves, and frozen foods there should be the designation of the month and year, and for fully preserved (sterilized) foods, only the year.)
 - b) Designation of the minimum storage life, as for example "May be stored at least..." (Unrestricted date designation as in (a))

Storage Life of Various Foods
of Animal Origin in Packages or Containers

The storage life is dependent on various factors, most important of all is the sanitary extraction and manufacture of the products, the method of preservation, the packaging and also the effect of suitable storage for the respective products. To judge how long the individual products of animal origin may be stored, dependence is put, for example, on changes in odor and flavor, or color and appearance, of consistency as well as, in the case of canned goods, of the condition of the can itself. Final judgment is limited by the vast area of preservation of nutrients and usability. The following data indicate a cross-section, which can be exceeded or restricted according to handling received.

1. Refrigeration

(From production date, storage at least - 18°C)

	Months
a) In the deep freezer	
Beef	9-12
Pork	4-6
Poultry	7-12
Lean fish	3-6
Fatty fish	2-3
b) Evaporative cooler - 12°C	
Beef	2-3
Pork	1-2
Poultry	1-2

- c) Refrigerator (to +5°C)
 Fish, crabs, and chopped meat 6-8 hours
 Leftovers 24 hours
- d) Room temperature (+22°C)
 Meat, poultry, fish, and crabs should not be stored at room temperature for hours because of the possibility of multiplication of microorganisms.

2. Partially Preserved and Stable foods

- a) Partially preserved
 Canned ham, sausage, in cool storage 3-5 months
 Fish preserves (very variable) in cool storage 1-2 months
 To be used immediately after opening; to be used within 1 day if stored at room temperature, and within 3 days if at refrigeration temperature.
- b) Stable foods
 Stable bologna, bacon (not sliced) 2-6 months

3. Full Preservation (sterile)

- Beef in its own juices, fatty meat)
 Ham in its own juices, beef rolls) 3-5 years
- Fully preserved fish, as fried herring)
 Fillet in sauce)
 Herring fillet in tomato or) 1-2 years
 mustard sauce)
- Sardines in oil, tuna 4 years or more

OTHER

In Pakistan, Spain, and Yugoslavia, the Grose Study suggests that most packaged foods must be marked with the date of packaging or production. "Perishable foods," furthermore, must be marked with the "time limit for use." (Grose Study)

APPENDIX III. DATE LABELING AND RELATED STATUTES (FEDERAL)

The following Federal laws on food labeling and related durability controls are provided as indicators of Federal activity in this field. Some States, it should be noted, typically follow the Federal lead and enact statutes similar to whatever Federal statutes are passed, and some States do not. To the extent that States do not extend Federal controls to goods and transactions beyond the jurisdiction of Congress or the coverage of Federal statutes, then consumers will be differently protected depending on the source of the food they are purchasing. The existence of Federal controls, ironically, may well indicate the need for uniformity and universality of regulation.

The Federal Meat Inspection Act

As discussed above in the section on Federal limitations on the power of States to impose date labeling or related controls on food distribution, the Federal Meat Inspection Act provides for inspection of meat processing plants which ship in interstate commerce. The statute does not require date labeling of any kind, and section 678 of the statute specifically forbids States to enact stricter requirements than are contained in the Federal act. The statute does not cover, however, two kinds of transactions: sales by meat processors who do not sell in interstate commerce and sales of repackaged meat, i.e., meat received by a purchaser from a federally inspected processor and repackaged for resale (typically to a consumer).

FDA Smoked Fish Labeling Regulation

The Federal Food and Drug Administration of the Department of Health, Education, and Welfare has recently proposed to adopt as a regulation, which would have the force of law, a rule which would require that smoked fish be labeled as follows:

(4) The shipping containers, retail packages, and shipping records shall indicate by appropriate labeling the perishable nature of the product and shall specify that the product shall be shipped, stored, and/or held for sale at 38° F. or below until consumed.

(5) Permanently legible code marks shall be placed on the outer layer of every finished product package and master carton. Such marks should show at least the date of packing and the plant where packed.

34 FEDERAL REGISTER 17176, 17178 (October 23, 1969). If the proposed rule is adopted, it will become part 128a of 21 CODE OF FEDERAL REGULATIONS. The regulations apply, of course, only to fish processing plants which are subject to Federal inspection, i.e., those which ship their product in interstate commerce. The regulation would not, therefore, apply to processors who did

not ship their products out of State. Just what the significance of the use of the word "should" in the operative language of the rule is is not known. Presumably the provision is not meant to be mandatory with respect to date labeling, but only with respect to the other stipulations, where the word "shall" is employed. The source of the difference is not known.

FDA Good Manufacturing Practices Regulation

The Commissioner of the Food and Drug Administration has also recently promulgated regulations to assure good manufacturing practices in the "manufacture, processing, packing, or holding of human foods." Although food industry spokesmen sought to have the Commissioner issue only "guidelines" instead of "regulations," the following regulations were promulgated:

All operations in the receiving, packaging, segregating, preparing, processing, and storing of food shall be conducted in accord with adequate sanitation principles. . . . All reasonable precautions, including the following, shall be taken to assure that production procedures do not contribute contamination such as filth, harmful chemicals, undesirable microorganisms, or any other objectionable material to the processed product.

. . .

(i) Meaningful coding of products sold or otherwise distributed from a manufacturing, processing, packing, or repacking activity should be utilized to enable positive lot identification to facilitate, where necessary, the segregation of specific food lots that may have become contaminated or otherwise unfit for their intended use. Records should be retained for a period of time that exceeds the shelf life of the product, except that they need not be retained more than 2 years.

34 FEDERAL REGISTER 6977, 6979 (April 26, 1969). The language used here could hardly be more misleading. The introductory, general paragraph states that the precautions which follow "shall be taken" but then the specific paragraph quoted uses the word "should." Because other specific paragraphs use the word "shall," it may be assumed that coded date labeling is not mandatory. It may be argued, however, that some method of enabling the manufacturer to identify contaminated or spoiled lots or batches is required, and that coded dating is only the recommended means. As a practical matter, however, there may be no other effective means, in which event date labeling would be required by default.

APPENDIX IV. SELECTED ANNOTATED BIBLIOGRAPHY

There follows a list of articles printed in legal periodicals dealing with the subjects of food labeling and the power of States to impose food labeling requirements. The list does not exhaust the available sources, nor is it intended to. It is designed to provide sources for further explanation or analysis of each of the topics under which the individual titles are gathered.

The notes which accompany the listings are not intended to describe all that appears in the listed article, but rather are designed to indicate that part of the article's contents which caused it to be included in the list.

Some topics discussed in the body of the report are not included; in those cases, either the discussion in the body is considered sufficient or there are no good sources of manageable length on the subject.

The topics under which the articles are gathered are as follows:

1. Food Labeling Laws--General
2. Food Labeling Laws--States
3. Food Labeling Laws--Foreign
4. Food Labeling Laws--Federal
5. Federal-State Relations
6. Interstate Commerce
7. Due Process Generally

1. Food Labeling Laws--General

Cohen, Milk Regulation: A Problem in Economics, Legislation, and Administration, 40 West Virginia Law Quarterly 247 (1934). (Traces the history of milk regulation by States; provides a good introduction to the subject of State regulation of food generally.)

Fenton, Some Problems of the Consumer: Information, Labeling, 15 Food, Drug and Cosmetic Law Journal 46 (1960). (Discusses possible consumer interest in and demands for packaging date labeling.)

2. Food Labeling Laws--States

Duffy, California Pure Foods and Drugs Acts and Related Laws, 16 Food, Drug and Cosmetic Law Journal 442 (1961). (Discusses, inter alia, the California Cannery Inspection Act, which is described in the Appendix of State Laws above, and which requires coded date labeling on all nonacid canned food containers.)

3. Food Labeling Laws--Foreign

Latin-American Food Code, 1964 Edition, 20 Food, Drug and Cosmetic Law Journal 505, 539 (1965). (Sets forth Article 86 of the Code, which requires a warning on containers of perishable food that the contents should be consumed immediately. The Code is revised occasionally to keep it "current" by the Latin American Food Code Council, which is composed of representatives of the 20 Latin-American countries and of Puerto Rico. The force or legal effect of the Code is not clear. See The Latin-American Food Code, 20 Food, Drug and Cosmetic Law Journal 238 (1965).)

Legislative Research Branch, Codex Alimentarius Commission, FAO/WHO, General Food Labeling Provisions, 19 Food, Drug and Cosmetic Law Journal 460, 481 (1964). (Reports the responses to a questionnaire sent to a group of countries asking for information about packaging or production date labeling.)

Van der Steur, Developments in the European Economic Community--Food Legislation, 20 Food, Drug and Cosmetic Law Journal 581, 584 (1965). (Mentions the general unpopularity of date labeling in the food industries of the European Economic Community countries.)

Van der Steur, Food Legislation in Europe, 19 Food, Drug and Cosmetic Law Journal 572, 587 (1964). (Discusses the tendency of European consumers to want processing dates or packaging dates provided to them.)

4. Food Labeling Laws--Federal

Rubenstein, Your Label, Labeling and the Law, 16 Food, Drug and Cosmetic Law Journal 366 (1961). (Discusses the general labeling information typically required by the Federal Food, Drug and Cosmetic Act. The author mentions no then-current date-labeling requirements.)

Meyers, Stability-Date Requirements Under the New-Drug Regulations, 14 Food, Drug and Cosmetic Law Journal 514 (1959). (Discusses the Federal requirement that for new drugs a statement of an expiration date must be supplied to the Food and Drug Administration if the company's required studies show that an expiration date is needed to preserve the drug.)

5. Federal-State Relations

Austern, Federalism in Consumer Protection: Conflict or Coordination, 20 Food, Drug and Cosmetic Law Journal 569 (1965). (Discusses the difference between State regulation for health purposes and State regulation for economic purposes. The author is wary of the effect of State regulation on national manufacturer's marketing practices.)

Christopher, Conflicts Between State and Federal Food and Drug Laws, 16 Food, Drug and Cosmetic Law Journal 164 (1961). (Discusses generally the subject described in the title, updating his earlier articles on the subject in the light of more recent cases. The author repeats his earlier conclusion that States have considerable latitude to regulate the food industry in the interest of the health of their residents, at least if they simply add requirements to those imposed by Federal law.)

Christopher, Federal Questions in State and Local Food and Drug Laws, 10 Food, Drug and Cosmetic Law Journal 261 (1955). (Discusses the problem of preemption of a field of regulation. The author concludes, and later cases have demonstrated the correctness of his conclusion, that States have considerable leeway to regulate food industry practices which may affect the public health, even though the State's regulations may impose substantial restraints on the movement of interstate commerce.)

Goodrich, Uniformity in Federal-State Food Regulations, 17 Food, Drug and Cosmetic Law Journal 305 (1962). (Discusses generally the need for uniformity between the Federal and State governments, without specifically mentioning labeling requirements.)

Harper, The Impact of Federal Law Upon State Law in the Field of Food and Drugs, 12 Food, Drugs and Cosmetic Law Journal 263 (1957). (Discusses the problem of preemption of State food and drug regulation by Federal statutes. The author's suggestion that State laws which impose requirements which are more stringent than Federal standards for the same product are invalid must be ignored in the light of later cases, but the article is a clear presentation of the argument against extensive State regulation.)

Markel, Federal Preemption, 17 Food, Drug and Cosmetic Law Journal 453 (1962). (Discusses generally the doctrine of Federal preemption with emphasis on food and drug regulation. The author asserts that the doctrine ought to be applied to prohibit a great deal of State food legislation; he takes what seems to be the minority view that State statutes which impose requirements in addition to those imposed by Federal law should be held invalid, at least if the State cannot affirmatively demonstrate a special need of its citizens not shared by the public at large.)

Note, Police Power, Due Process, and State Regulation of Food Production and Distribution, 16 Michigan State Bar Journal 113 (1937). (Although the discussion centers on the milk industry, the points raised are equally applicable to other foods. The note provides comprehensive introduction to the rules which limit the power of States to regulate food industries in the interests of their residents. The note is somewhat dated, however, in that courts now tend to have a more liberal view of the power of legislatures to enact laws designed to protect health, safety, and welfare--even economic well-being.)

6. Interstate Commerce

Note, Milk Control Statutes, 14 New York University Law Review 375 (1937). (Discusses generally the power of States to regulate the milk industry in ways having an economic impact. Both milk in interstate commerce and milk in only intrastate commerce are discussed. Although the note does not discuss the regulation of other food industries, the discussion should be applicable to all foods.)

7. Due Process Generally

Carpenter, Substantive Due Process at Issue: A Resume, 5 University of California at Los Angeles Law Review 47 (1957). (Discusses at some length and with accuracy the historical development of the due process limitation on the power of legislatures. The discussion is now dated, because substantive due process has been pretty much a dead letter since the late 1930's, but the background is useful for purposes of understanding the discussion under the due process limitation sections in the body of this report.)

8168 3262 49
10•20•99 — MAB

INFORMATION
CONSERVATION, INC.



